United States
Department of
Agriculture

December 1987

1987 Report on USDA Human Nutrition Research and Education Activities

A Report to Congress

PREFACE

This report was prepared under the auspices of the USDA's Subcommittee for Human Nutrition, Research and Education Committee of the Secretary of Agriculture's Policy and Coordination Council.

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Agency Abbreviations

Agency	Agency Abbreviation
Agricultural Marketing Service	AMS
Agricultural Research Service	ARS
Agricultural Stabilization and Conservation Service	ASCS
Cooperative State Research Service	CSRS
Competitive Research Grants Office	CRGO
Economic Research Service	ERS
Extension Service	ES
Food and Nutrition Service	FNS
Food Safety and Inspection Service	FSIS
Human Nutrition Information Service	HNIS
National Agricultural Library	NAL
Office of Governmental and Public Affairs	OGPA
Office of Grants and Program Systems	OGPS
Office of International Cooperation and Development	OICD

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EXECUTIVE SUMMARY

Introduction

The provisions of section 1452(a) of the National Agricultural Research, Extension and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note) required the Secretary of Agriculture to submit to Congress in December 1986 a comprehensive plan for implementing a national food and human nutrition research program including recommendations relating to research direction, educational activities and funding levels necessary to carry out such plan.

Section 1452(b) requires the Secretary annually thereafter to submit a report on the human nutrition research activities conducted by the Department of Agriculture. This first report summarizes the Department's activities in human nutrition research and education during FY 1987. Emphasis is placed on new directions and highlights. No effort has been made to restate the detailed program plan as outlined in last year's report.

Human Nutrition Research

The USDA human nutrition research projects initiated, research highlights, and other research findings during fiscal year 1987 are presented for the following six areas:

- o Human nutrition requirements
- o Energy regulation and role of nutrients in health promotion
- o Food composition and bioavailability of nutrients
- o Food and nutrition monitoring research
- o Food and nutrition information and education research
- o Research on government policies and socioeconomic factors

The numbers of USDA research projects included in the Human Nutrition Research Information Management System for FY 1986 are presented for different Federal nutrition code categories.

USDA research is uniquely equipped to find solutions to national nutrition problems linked to the food supply. Research findings are summarized concerning nutritional requirements, food composition and bioavailability of nutrients, food consumption trends, nutritional status assessment, and nutrition education methods which focus directly on these problems.

Human Nutrition Information and Education

In FY 1987, the eight or more USDA agencies largely responsible for food and nutrition information and education continued programs to meet their clients needs. Improved communication and cooperation among agencies on information

and education projects was promoted, especially by the Subcommittee for Human Nutrition of the Committee on Research and Education and by the Assistant Secretaries for Food and Consumer Services and for Science and Education.

The USDA activities are summarized by new initiatives and ongoing programs. For example "Improving Nutrition, Diet and Health" is one of eight major initiatives of the Extension Service.

Ongoing programs are presented under the following headings to illustrate the improvement in coordination around major goals. These are:

- o USDA's responsibility to assure that the Federal government "Speaks with one voice" when issuing dietary guidance.
- o Improved linkages between research and information and education activities.
- o Coordinated delivery of message.

Funding levels

The expenditures or estimated expenditures for human nutrition research and human nutrition information and education by the several USDA agencies for fiscal years 1983 through 1988 are given. The total amount of human nutrition research support by USDA has increased from $47.8 million in FY 1983 to $61.5 million in FY 1988, or an increase of 28.7 percent. During the same period, USDA support for human nutrition information and education has increased from $120 million to $137.5, an increase of 14.6 percent. Most of the funds for information and education activities were distributed to and managed by State agencies. The total USDA support for human nutrition in FY 1987 was $191.0 million and is estimated to be $199.0 million in FY 1988.

Coordination

Coordinating mechanisms and advisory bodies used during FY 1987 are described. These are grouped as follows:

- o Coordination within the Federal sector
- o Coordination within USDA
- o Coordination with the private sector
- o Advisory groups

Much progress has been made in achieving coordination with other agencies, Departments, and the private sector in order to provide satisfactory services within available resources.

1987 ANNUAL REPORT ON USDA HUMAN NUTRITION RESEARCH AND EDUCATION ACTIVITIES

A REPORT TO CONGRESS

I. INTRODUCTION

A. Charge

A U.S. Department of Agriculture (USDA) comprehensive plan for implementing a national food and human nutrition research and education program was submitted to the Congress in December 1986 in accordance with the provisions of section 1452(a) of the National Agricultural Research, Extension and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note). Section 1452(b) requires the Secretary annually thereafter to submit a report on the human nutrition research activities conducted. Accordingly, this report endeavors to summarize the USDA human nutrition research and education activities during FY 1987, with emphasis on new directions and highlights. No effort has been made to restate the detailed program plan as outlined in last year's report.

B. Legislative

USDA has had no new legislative mandates or change in mission since the 1986 report. The "National Nutrition Monitoring and Related Research Act of 1987" (S-1081 and H.R. 2151 of the 100th Congress), if enacted, will have considerable effect on the agency's program. The Act requires the Secretaries of USDA and the Department of Health and Human Services (DHHS) to develop a comprehensive plan for monitoring with numerous "minimum components", to establish an advisory council, and to publish jointly approved dietary guidelines and guidance.

C. Changes in Resources or Infrastructure

1. Children's Nutrition Research Center (CNRC) Building Nearing Completion

The CNRC building under construction in Houston, Texas, was topped out in March 1987 and the projected completion date is for the second quarter of FY 1988.

This is an 11-story building with a 3 level underground parking garage and a tunnel/elevator pod connecting it to the Texas Children's Hospital (TCH). The building is located on approximately .97 acres of land leased from the Texas Medical Center. The gross area of the building is approximately 208,000 square feet which provides 131,774 net square feet of space for 5 general categories of use: research, education, offices, research support, and administrative support. More than 50 percent of the facility is dedicated to research. The structural frame of the building will be reinforced concrete clad in a skin of glass and natural Texas granite.

2. Cooperative State Research Service

Reference, pages 16-17, section II.B.2., 1986 report to Congress "USDA Comprehensive Plan for a National Food and Human Nutrition Research and Education Program," this section is updated as follows:

"The Higher Education Programs office (HEP) is charged with informing the Secretary of the Nation's needs for scientific and professional expertise in the food and agricultural sciences, and developing and administering programs to assure the Nation of an outstanding cadre of food and agricultural scientists and professionals. The following activities of HEP relate to food science and human nutrition:

- Administering competitive institutional grants awarded through peer review to support graduate training in food science and human nutrition. The purpose of the Competitive Graduate Fellowship Program is to increase both the number and the quality of future graduates trained at centers of excellence.

- Serving as a resource for various Federal agencies, organizations, and the public seeking information concerning higher education related to food and human nutrition (academic programs, degrees granted, students enrolled, faculty statistics, career opportunities, etc.)

- Enhancing the data (students, faculty, programs, etc.) essential to education planning, resource allocation, and evaluation by working with professional organizations and Federal agencies concerned with higher education in food science and human nutrition in order to standardize survey methodology and procedures, ensure accurate information for policy making, and reduce the data collection burden.

Contact: Marge Stanton, Higher Education Programs -- 202/447-6020"

3. Agricultural Marketing Service (AMS) Initiated Consumer Information Service

AMS added to its information staff to provide radio, TV, and press services through the Department's Office of Information. One of the staff's activities is to reach consumers with information on how to buy food.

II. HUMAN NUTRITION RESEARCH ACTIVITIES

The USDA human nutrition research has traditionally been linked with the nutritive value of foods, human nutrition requirements, and the kinds and amounts of foods that Americans consume in relation to their requirements and plans for improving diets. USDA is uniquely equipped to find solutions to national nutrition problems linked to the food supply. Its research findings on human nutrient requirements, food composition and bioavailability of nutrients, food consumption trends, nutritional status assessment, and nutrition education plans have contributed directly to the prevention or solution of these problems.

The information gained from human nutrition research forms the basis for dietary guidelines and for developing nutrition education programs for professionals and consumers. Such information is required to develop improved plant and animal food products that will support optimal health and well-being and to devise optimal food assistance programs for those most at risk.

A computer search by nutrition codes was made on October 20, 1987, of the 1,003 USDA projects included in the Human Nutrition Research Information Management System (HNRIMS). The results are shown in Table 1. This table

Table 1

USDA Research in Human Nutrition
(from HNRIMS, October 20, 1987)

HNRIMS Nutrition Code Area	USDA Projects* Number	USDA Projects* %	USDA Projects % of Federal Research in Area
Normal Human Requirements for Nutrients			
1. Maternal	47	5	26
2. Infant and Child	53	5	16
3. Adolescent	19	2	24
4. Adult	62	6	53
5. Elderly	28	3	19
13. Nutrition and Function	80	8	24
14. Nutrient Interactions	133	13	24
Energy Regulation and Role of Nutrients in Health Promotion			
6. Cardiovascular Disease and Nutrition	54	5	11
7. Cancer	27	3	4
8. Other Diseases (Osteoporosis, Diabetes)	36	4	7
11. Obesity, Anorexia and Appetite Control	28	3	8
17. Carbohydrates	64	6	30
18. Lipids	131	13	23
20. Proteins and Amino Acids	125	12	28
21. Vitamins	92	9	15
22. Minerals and Trace Elements	184	18	37
24. Fiber	44	4	54
Food Composition and Bioavailability of Nutrients			
26. Food Composition	240	23	78
27. Bioavailability of Nutrients	113	11	60
28. Effects of Technology on Nutritional Characteristics of Food	317	32	94
29. Other Food Science Research	153	15	85
Food and Nutrition Monitoring Research			
16. Nutritional Status	130	13	32
30. Food Consumption Surveys	42	4	58
31. Dietary Practices, Food Consumption Patterns	92	9	30
Food and Nutrition Information and Education Research			
32. Methods for Informing Public About Nutrition	18	2	21
33. Other Nutrition Education Research	14	1	36
Effects of Gov. Policy and Socioeconomic Factors			
34. Effects of Gov. Policy and Socioeconomic Factors on Food Consumption and Nutrition	35	3	76

*Numbers are not additive as projects may be assigned more than one nutrition code (1,003 USDA research projects in system).

lists the number of USDA projects by category under six research areas. It also gives the percentage of the total number of research projects in HNRIMS for all Federal agencies represented by USDA projects, by nutrition code category. These include projects conducted by the State agricultural experiment stations and 1890 land-grant institutions and Tuskegee University, some of which receive no Federal funds. Total Federal funds expended by USDA for human nutrition research and education in FY 1987 amounted to $191.9 million (see table 2).

A. Human Nutrition Requirements (ARS, CSRS)

USDA intramural research in human nutrition has contributed significantly to the development of information now available on human requirements for many essential nutrients by age and sex. In fact, the estimated safe and adequate ranges of daily dietary intakes for selenium, copper, and chromium, as well as the Recommended Dietary Allowances for iron and zinc, are based largely on USDA studies. In addition, requirements for vitamin B-6, folacin, and vitamin C in women; vitamin D, vitamin K, calcium in the elderly; and energy and protein needs of infants and lactating women are being further studied and refined. Studies are underway on iron and molybdenum in men and boron in postmenopausal women. Such information about nutrient requirements of humans is used in providing better nutritional guidance, more nutritious foods, and better nutrition.

The Children's Nutrition Research Center at Baylor College of Medicine, Houston, TX, is dedicated to the study of nutritional needs of pregnant and lactating women and of infants and children, with particular attention to the quantification of nutritional needs for optimal nutritional status and performance. A unique facility within the Center is the Stable Isotope Laboratory which has the capacity to measure nutrient needs in a non-invasive manner with precision. The Center has studied energy, protein, and calcium needs of lactating women and infants, and devised new methods for measuring body protein and fat in infants.

The Human Nutrition Research Center on Aging at Tufts University, Boston, MA, has a mission to determine the nutrient needs of the elderly and the relationship of dietary factors to the aging process. Studies have been initiated on the requirements for vitamin D, vitamin K, folacin, protein, and calcium in the elderly. Other studies are being directed to the manner in which diet can delay or prevent the onset of degenerative conditions associated with aging.

The Grand Forks Human Nutrition Research Center develops recommendations for nutrient intakes by humans and identifies useful forms from food sources, particularly of minerals. This Center has provided highly relevant information on the dietary needs for zinc, copper, iron, and, more recently, boron.

The Beltsville Human Nutrition Research Center focuses on the requirements in humans of selenium, chromium, copper, biotin and vitamin E and the bioavailability of nutrients in foods.

The Western Human Nutrition Research Center continues studies to refine the dietary requirements for vitamin B-6, folacin, vitamin C, dietary lipids, iron, copper, and zinc.

The Cooperative State Research Service, through its Competitive Research Grants Office (CRGO), awarded 24 new and 3 continuing grants in human nutrition, totaling $2,253,396 in FY 1987. New grants ranged in size from $40,000 for 1 year to $270,000 for 3 years. The majority of the grant proposals received dealt with vitamins or minerals. Eleven of the new grants were awarded for projects relating to vitamins, and six to minerals.

1. Research Initiated

o Studies on Maternal Diet and Low Birth Weight Infants

An epidemiological investigation which will collect information on dietary intakes and nutritional status of mothers in a population with a high incidence of low birthweight is being initiated. This will be the first stage of a series of investigations on the role of maternal diet on the outcome of pregnancy at the Children's Nutrition Research Center (CNRC).

o Consequences of Suboptimal Trace Element Nutrition

The importance of trace elements, with emphasis on zinc, copper, and boron will be determined for normal physiological function of various animal and human systems including the cerebrovascular system; for normal biochemical function of various cellular components including cell membranes; and for the maintenance of normal morphology of body structures including bone and brain.

Animals will be fed diets in which the amounts of specific trace elements and other selected nutrients and non-nutrients are accurately controlled and systematically varied. The response of the animals to the dietary manipulations will be ascertained by performing various biochemical, physiological and anatomical methodologies.

o Micro-Nutrient Requirements of the Elderly

Human subjects are used to study the vitamin K and vitamin B-6 requirements of the elderly. Vitamin A, vitamin K, and vitamin D metabolism also will be studied in animal models.

o Vitamin A Requirement

A number of strong proposals dealing with vitamin A were received by CRGO. This vitamin has long been recognized as important in growth and development, vision, and possibly protection against cancer. Previous work supported by USDA's CRGO program has led to important discoveries of the possible functions of vitamin A, and of improved methods of determining body reserves. These programs will continue. A new, more sensitive method has been devised for separating and quantitating the various forms of vitamin A, and this will be used to determine more precisely total body stores of the vitamin, especially in cases of marginal vitamin A in the diet (as in underdeveloped countries), or subtoxic levels (as may be observed in people taking megavitamin doses in an attempt to protect against disease).

Other ongoing studies which will be continued deal with the function of vitamin A in growth and development. It has been shown that the vitamin is involved in regulation of important cellular proteins found at the surface of the cell, which may affect differentiation. It is thought that vitamin A

directly affects gene expression of the protein fibronectin. New projects initiated this year include an examination of the relative effectiveness of dietary b-carotene and vitamin A on increasing tissue vitamin A level; determination of whether photosensitizers like vitamin B-2 increase vitamin A requirement by increasing light induced loss of vitamin A; and determination of the function and metabolism of vitamin A in the small intestine. For this latter project, the exciting modern technique employing monoclonal antibodies will be used to localize vitamin A in the intestine.

o Behavioral Effects of Nutrient Imbalance

Other new areas funded in FY 1987 by CRGO deal with the behavioral effects of nutrient deficiency or imbalance. The effect of amino acid imbalance on brain neurotransmitters and the subsequent effects on human disorders of food intake, leading to anorexia or overeating, is an important one. These studies complement ongoing studies of the effects of maternal vitamin B-6 deficiency on development of brain neurotransmitters in the offspring. The effect of marginal zinc deficiency in infants is also important and will be studied; behavioral changes and developmental delays have been shown to occur in mild zinc deficiency.

2. Research Highlights

o Boron Needed for Mineral Retention

Studies with animals at the Grand Forks Human Nutrition Research Center have shown that the trace mineral boron is involved in mineral metabolism and response to high dietary aluminum and low dietary magnesium. Bone calcification is affected. As a followup, a recent study was conducted in a metabolic unit with 13 postmenopausal women fed a low boron diet made from conventional foods, but low in fruits and vegetables. When boron was added to the diet after 119 days on the low-boron diet, the serum estradiol 17 beta concentration doubled and the loss of calcium, phosphorus, and magnesium in the urine decreased. The findings suggest that boron affects calcium, phosphorus, and magnesium excretion and that ample boron supplied by fruits and vegetables may help to reduce the risk of osteoporosis.

o Foods With Non-Radioactive Labels Used to Study Metabolism in Infants

Human milk and rice have been labeled with non-radioactive isotopes. They are being used in lactating women and infants and allow detailed study of important questions, for example, how human milk protects infants against infections.

o Vitamin D May be Low in the Elderly

Studies at the USDA Human Nutrition Research Center for Aging indicate that a significant number of the elderly are not receiving adequate levels of vitamin D from dietary and solar sources. Aging appears to decrease the capacity of human skin to produce vitamin D-3. Studies reveal an inverse relationship between the concentrations of provitamin D-3 in the epidermis with age, indicating that aging decreases the capacity of human skin to produce vitamin D. Exposure to sunlight only during the months of March through October in

Boston resulted in conversion of provitamin D-3 to previtamin D-3, with none occurring during the period from November to March. Deficiency of vitamin D leads to loss of calcium from the bones and may result in osteoporosis and bone fractures. In a recent study, 40 percent of patients entering a Boston hospital had little or no vitamin D in their blood. Decreased milk consumption is the major cause of age-related vitamin D deficiency, followed by reduced exposure to the sun.

o Selenium Requirements

The data for establishing the selenium requirement of adult humans was reviewed. Healthy North American men and women need about 80 and 57 micrograms of selenium per day to maintain balance. This amounts to approximately 1 microgram of selenium per kilogram of body weight daily. On the other hand, selenium intakes as low as 24 and 9 micrograms per day were sufficient to maintain balance in New Zealand women and Chinese men, respectively. In China, dietary selenium intakes were reported to be about 8 and 19 micrograms per day for adult males in endemic and non-endemic Keshan disease areas, respectively. Repletion of Chinese men of very low selenium status with graded levels of selenomethionine revealed that plasma glutathione peroxidase activity plateaued at similar values in all groups given 30 or more micrograms of supplemental selenium daily. On this basis, a physiological selenium requirement of about 40 micrograms per day was suggested for Chinese adult men.

o Nutritive Intake of Breast Fed Infants

Energy intakes of breast-fed infants remain significantly below current recommendations (about 15-20%) even after the ad libitum introduction of solid foods to supplement breast milk. These findings strongly suggest that present estimates of energy requirements of infants is excessive.

3. Other Findings

o Premature Infants May Require Pyridoxal Phosphate

It has been found that premature infants are unable to convert pyridoxine (the form usually present in vitamin supplements) to the active form, pyridoxal phosphate. This is a significant discovery and may have a significant positive impact on the survival of such children. The proposed mechanism of action needs confirmation.

o Exercise Increases Chromium Need

Results obtained indicate that regular exercise may increase chromium uptake and excretion and that high sugar diets also increase chromium excretion. The biologically active form of chromium involved has not yet been established.

o Vitamin B-12 Requirements

Studies on the bioavailability of vitamin B-12 were done at the USDA Human Nutrition Research Center on Aging at Tufts University, Boston, in humans with mild atropic gastritis, a commonly observed condition among the elderly. Radiolabeled crystalline vitamin B-12 was found to be absorbed equally well

(20%) in normal controls and subjects with atropic gastritis. Protein-bound vitamin B-12 absorption was 10-15 times less bioavailable than crystalline vitamin B-12 in both control and persons with atropic gastritis. However, subjects with mild atropic gastritis absorbed significantly less of vitamin B-12 bound to chicken serum protein than did controls. This uptake of protein bound vitamin B-12 in subjects with atropic gastritis was improved comparable to that of normal controls after tetracycline therapy for 10 days. The antibiotic had no effect on absorption of protein bound vitamin B-12 in controls. It appeared that the small amount of vitamin B-12 released from chicken serum protein was metabolized by intestinal bacteria in individuals with mild gastric atrophy.

o Vitamin C Requirements

A 14-week study was conducted on vitamin C requirements of 11 healthy males kept in a live-in metabolic ward at the Western Human Nutrition Research Center. Using controlled intakes of 5 to 605 milligrams of ascorbic acid per day over 14 weeks, daily intakes of 41 and 138 milligrams were calculated to maintain plasma ascorbic acid at levels above 0.4 and 1.0 milligrams per deciliter, respectively. Propensity for the gums to bleed or become inflamed upon probing was reduced as dietary ascorbic acid was increased through all levels. However, urinary hydroxyproline, a pre-scorbutic measure of collagen turnover, was undisturbed on both the normal and high levels.

o Absorption and Utilization of Dietary Carbohydrates by Young Infants

The ability of one-month old infants to digest and absorb short and long chain glucose polymers has been compared. Short chain glucose fractions are well utilized and the majority of the infants tested were able to digest the long chain polymers, although this may involve colonic fermentation.

o Role of Dietary Fat in Human Milk Production

The caloric value of human milk is strongly dependent on its fat content, and fat is the single most variable nutrient component in milk. Studies in lactating women using non-radioactive labeled fats, have revealed that about 30 percent of human milk fat is derived directly from dietary lipids, 10 percent from endogenous mammary synthesis and 60 percent from body lipid storage sites in the body. Accordingly, the fatty acid composition of breast milk may be influenced by the amount and type of dietary fat consumed during lactation.

o Zinc Status During Pregnancy Studied

Studies in the pregnant ewe indicate that inadequate zinc status may contribute to poor pregnancy outcome in humans. Low zinc intakes in pregnant ewes resulted in abortions, malformations, intrauterine growth retardation, and fetal mortality. Improved sensitive methods for assessing marginal zinc status also were studied. The most promising indicators are the increased activity of mannosidase and angiotension converting enzyme with addition of zinc to plasma *in vitro*.

B. Energy Regulation and Role of Nutrients in Health Promotion (ARS)

1. Research Initiated

o Direct Calorimeter for Human Studies

Recently, the Beltsville Human Nutrition Research Center has completed a room-sized calorimeter that permits the accurate direct measurement of energy production by humans under various conditions. These direct measurements will permit improvement in assessing the energy values in typical mixed diets. A systematic revaluation of the energy content of foods is also underway. The Beltsville calorimeter will be used to characterize the extent to which energy expenditure of individuals is influenced by season, activity, adaptation to diet and by body composition.

o Effects of Dietary Fat Intake

Several recent studies have shown that diets low in total fat and saturated fat and high in dietary fiber result in lower levels of serum cholesterol and other serum lipids, risk factors associated with coronary heart disease. Blood pressure was also reduced when dietary fat level was lowered and the ratio of the polyunsaturated to saturated fatty acids increased. Lean meat trimmed of separable fat and fat-free milk did not increase serum cholesterol levels when included in low-fat diets.

The Lipid Nutrition Laboratory of the Beltsville Human Nutrition Research Center has conducted studies to determine the effects of dietary fat level and type on metabolism and other related physiological parameters in free-living human volunteers and experimental animal models. Major changes in fatty acid profile of phosphoglyceride, triglyceride, cholesterol ester and free fatty acid fractions of human plasma were observed as a result of consuming eicosapentaenoic, a polyunsaturated fatty acid found in marine fish oils. These investigations may prove useful to evaluate the popular use of marine oil supplements in human diet. Methods with high precision and reliability were developed to detect prostaglandin metabolites in urine; these methods are useful in the area of lipid metabolism in humans. Scientists of the laboratory further demonstrated that a rat diet containing 4 percent menhaden oil increased eicosapentaenoic acid from zero to 8-10% of the total fatty acids in the platelet membrane phospholipids.

o Calcium Loss from Bones

Investigators at the USDA Human Nutrition Research Center at Tufts University, using dual photon absorptiometry have measured bone density of the spine in 76 healthy postmenopausal women at 7 month intervals. Women with calcium intakes less than 405 milligrams daily lost spine density at a significantly greater rate than did women with calcium intakes over 777 milligrams per day. There appears to be a threshold of calcium below which increased calcium intake is likely to be beneficial in reducing spine mineral loss. To define the relationship between calcium intake and rate of axial bone loss, a longitudinal intervention study involving 360 postmenopausal women has been initiated. In this study, 500 milligrams of supplemental calcium is being administered in two forms over a 5-year period. Physical activity, blood pressure, bone density, spine fractures and other aspects of calcium metabolism will be measured.

- Effects of Dietary Fatty Acids on Platelet Function and Eicosanoid Biosynthesis

Studies have been initiated to elucidate the mechanisms responsible for the physiological effects of dietary lipid modifications by studying the associated qualitative and quantitative changes of eicosanoid metabolism of essential fatty acids and to determine to what extent n-6, n-3, and n-9 series fatty acids influence the formation of those eicosanoids (thromboxane, prostacyclin), which are relevant to the onset and progression of the cardiovascular disease.

Studies with rats suggest that a selenium-deficient diet can result in an increase in the platelets of proaggregatory thromboxane and a decrease in antiaggregatory prostacyalin due to reduced glutathione peroxidase levels.

- Cholesterol Removal from Dairy Foods

Studies have been initiated to develop a cholesterol assimilating microorganism used in food production by genetic technology. Sixty lactic acid producing bacterial strains were evaluated systematically for growth in the presence of bile acids, a compound derived from cholesterol. However, none of the resistant organisms were able to use cholesterol from the substrate provided. Gene transfer techniques were then developed to facilitate transfer of bile acid resistance from lactobacilli to the more widely used streptococci. Strains were successfully transfected with plasmid DNA carrying identifiable phenotypic markers. If such an organism can be used to degrade the preformed cholesterol and lactose at the same time, an improved nutritional dairy product can be developed.

- Immunocompetence and Nutritional Status Assessment

Human volunteers, maintained in a metabolic ward, and fed diets marginally adequate in specific essential nutrients will be studied to determine if an immune response test may be used to detect marginal nutrient deficiency or nutritional status. *In vitro* and *in vivo* indices of immune status will be studied. Lymphocytes and macrophages isolated from peripheral blood will be cultured *in vitro*. The growth stimulation by T and B cell specific mitogens and interluken 1 and 2 secretion into the culture media will be determined. Levels of circulating immunoglobulins, secretory immunoglobulins, delayed type hypersensitivity and complement activity will be monitored. Some studies also will be done using animal models.

2. Research Highlights

- Body Composition Measurements in Infants

Two noninvasive techniques to measure body composition of infants have been developed and validated by scientists at the USDA Children's Nutrition Research Center, Baylor College of Medicine, Houston, Texas. One method which uses the acoustic plethysmograph to measure body volume, requires only 1 minute per measurement, has a low coefficient of variation and is reproducible on the same infant on consecutive days. The other method measures total body electrical conductivity (TOBEC), a rapid, safe and noninvasive method of

estimation of fat-free mass. TOBEC uses an electromagnetic field to measure the amount of water in a subject's body, which is used to calculate the amount of fat. A correlation coefficient of 0.949 was obtained between the natural log of the TOBEC number and total body water determined by isotopic dilution technique using $H_2^{18}O$ in a study involving 16 infants. The TOBEC method is highly suitable for use with human infants and appears to determine body composition as accurately as other available methods. The standard technique of measuring body fat--underwater weighing--is inconvenient and inappropriate for very young or elderly subjects.

o Diet and Exercise in Weight Loss

The method used to evaluate weight reduction programs is inadequate as only total pounds of weight loss, rather than fat loss, are measured. To compare the relative effectiveness of two approaches to weight loss, two groups of moderately overweight women, living in a metabolic unit at the Western Human Nutrition Research Center were subjected to one of two programs. In one group the daily caloric intake was reduced by 50 percent to 1,200 kilocalories of metabolizable energy; in the other, the caloric intake was reduced by 25 percent to 1,800 calories per day and energy expenditure was increased by 25 percent through controlled exercise. Although the diet only group lost more total weight than the diet and exercise group, fat weight loss was the same between both groups. The diet alone group lost more body water and lean body mass than the diet and exercise group. The women in the exercise group were able to consume 50 percent more food and improve their fitness, yet achieve the same total fat loss as the group which restricted calories but did not exercise.

o Genetic Marker For Identifying Individuals With Greater Risk of Coronary Artery Disease (CAD)

Scientists at the USDA Human Nutrition Research Center on Aging, Boston, Massachusetts, have discovered a specific Apo A-I gene polymorphism associated with a high density lipoprotein (HDL) deficiency, a condition commonly observed in individuals with Coronary Artery Disease (CAD). Apo A-I is the major protein in HDL. This gene defect was found in only 4 percent of normals, 32 percent of CAD patients and 66 percent of individuals with genetic HDL deficiency. This finding is important as the genetic marker may be useful in identifying subjects at increased risk for CAD and recommending appropriate risk factor modifications.

o New Mechanism of Regulating Iron Uptake

USDA scientists at the Human Nutrition Research Center on Aging at Boston, Massachusetts, have found a protein which regulates messenger RNA for at least one of the two ferritin protein subunits. The amino acid structures of the two ferritin protein subunits (H and L) were established by sequencing the complete messenger RNA for each subunit harvested from rat liver. In rats not given extra iron, most of the messenger RNA is rendered inactive by this regulatory protein. Scientists have found that as soon as "free" iron is inserted into liver cells in culture, the inactive messengers engage with the cell ribosomes and the synthesis of subunit ferritin protein begins. The identification of a regulatory protein which is sensitive to unbound iron in the cell is an important breakthrough in understanding the mechanism of

regulating iron metabolism and ferritin formation inside the cell. The binding of excess iron by ferritin prevents damage to cell components, notably lipids in membranes. Excess iron storage is sometimes a problem in the elderly. This effect of iron with aging is being explored.

o Components of Starch Maintain Normal Glucose Metabolism

Of the two components of starch, amylose and amylopectin, amylose has been found to improve the utilization of glucose and reduces the need for insulin in human subjects. In addition, certain blood fats are also decreased. Long-term consumption of foods high in amylose (beans, peas, and other legumes) may thus lower the risk of developing diabetes.

3. Other Findings

o Actual and Calculated Metabolizable Energy Values of Diets Compared

The metabolizable energy content of foods as published in USDA Handbook #8 are calculated from specific energy conversion factors derived by Atwater at the turn of the century for the fat, protein and carbohydrates of different food groups of the typical mixed diet. Since the composition of mixed diets consumed by the population changes, it was considered important to determine if these energy conversion factors still give an accurate indication of the metabolizable energy of the diet. Beltsville Human Nutrition Research Center scientists have found that when food lipids are mainly triglyceride, the heat of combustion of several lipid fractions from food products were within 2 percent of those determined by Atwater. However, when the food lipid had a high content of phospholipid, the values obtained were lower than those of Atwater. In several other studies, metabolizable energy measurements have been made on mixed diets consumed by human subjects. These have ranged from 7 to 12 percent lower than was obtained by calculation using handbook #8 values. USDA scientists are studying those factors that may be causing these overestimations so that appropriate corrections can be made.

o Diet and Cancer Risk

A quantitative measure of fecal mutagenicity in biological extracts has been developed and successfully tested. This is a rapid and reliable marker to estimate risk for bowel cancer. The test has been applied successfully to stools from human subjects on a variety of diets. The results may help to reduce cancer risk by dietary means. Also, a procedure for the isolation of genomic high molecular weight DNA from human stools was developed; this is a research breakthrough which has many potential uses in research on gene expression in human epithelium.

o Body Composition Measurement Techniques for Adult Humans

Body composition of large numbers of human volunteers will be measured by various methods including anthropometry, skin fold thickness, body density (under water weighing), 40-potassium counting, stable isotope dilution for body fluids, bioelectrical impediance and total body electrical conductivity (TOBEC). This is an effort to evaluate and validate the appropriate methods for specific uses.

Thus far, 1,500 subjects have been studied in the cross-validation project involving four Centers. The compact size of the bioelectrical impediance analyzer (BIA) makes it ideal for body composition measurements in field surveys. Good agreement between BIA and TOBEC was observed and these agree well with body composition as determined by body density or body water methods.

o Vitamin C Delays Cataract Formation

Eye lens opacification and cataract formation upon aging appears to be related to an inability to remove damaged proteins. Proteolysis by action of proteases provides a means of editing the cellular proteins and recycling amino acids of disposable proteins. Solar light (UVH and B) inactivate certain proteolytic enzymes and cause lens protein aggregation similar to that which occurs in cataracts. Elevated dietary ascorbic acid (vitamin C) was found to result in elevated lens ascorbate in guinea pigs and an enhanced ability to withstand UV-induced damage to lens protein and enzymes. This implies that attenuation of the protein catabolizing machinery may be causally related to the accumulation of damaged proteins which is associated with cataract formation and that dietary antioxidants may offer protection against these insults.

o Fatty Acid Metabolism Studied

A direct comparison of the metabolism of fatty acids present in our diets was done at the U.S. Northern Regional Research Center, Peoria, Illinois, by using mixtures of non-radioactive isotope labeled fats fed to adult male subjects. The results revealed that incorporation of saturated, mono- and polyunsaturated fats into blood lipid fractions are under tight biological control. Excess fatty acids not required to meet cell and membrane requirements are shunted into body fat or burned for energy. The results indicate that a large excess of polyunsaturated fat in the diet of healthy individuals has little nutritional benefit. Because of various control mechanisms, structurally rearranged polyunsaturated fat acids present in hydrogenated oils were found not to be a nutritional liability at the levels presently consumed. Two of the structurally different "trans" fatty acid isomers present in hydrogenated vegetable oils, when fed to mice, were found to be more like mono-unsaturated or saturated than polyunsaturated fats. They were efficiently absorbed but were not selectively incorporated into plasma lipid classes and were chain shortened 2 to 3 times more rapidly than similar fatty acids with a "cis" or unmodified structure.

o Fluidity of Lipoproteins Affected by Fat Level and Saturation

Erythrocyte ghost membrane fluidity and insulin binding were significantly increased when high levels of polyunsaturated fats were fed to healthy free-living premenopausal women. Low fat (20% of energy) diets in women yielded more fluid Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL) than did diets with high fat (40% of calories). Reducing fat intake lowered LDL cholesteryl linoleate and raised cholesteryl oleate content. Moderate vitamin E supplements reduced HDL fluidity in women but not men, both consuming self-selected diets. These findings will be important in planning dietary recommendations to prevent late-onset diabetes and heart disease as the membrane lipid environment effects on the insulin receptor constitute an interface between carbohydrate and lipid metabolism.

o Beneficial Effects of Human Milk for Infants

In an epidemiologic study, it was found that malnutrition is a primary factor leading to severe formula intolerance. Lactoferrin has been identified as the major protective protein in human milk which spares breast-fed infants from this problem of food intolerance. Lactoferrin is known to help infants absorb iron from mothers milk and to protect infants against intestinal infection. Results of the present study indicate that lactoferrin also stimulates growth and maturation of the gastrointestinal tract of the newborn.

C. Food Composition and Bioavailability of Nutrients (ARS, HNIS)

1. Research Initiated

o New Methods for Analyzing Trace Elements and Fiber in Foods

Atomic absorption using a pulsed continiuum source with a photodiode will be devised. The instrument will be used to analyze trace elements (in foods) in the far ultra-violet wave length region with a graphite furnace atomizer. The controversial iron spectral interference on selenium analysis will be evaluated. Also, a constant temperature carbon furnace atomizer combined with multielement atomic absorption/emission spectrometer will be evaluated for use in trace mineral assays on foods. In addition, a combination of selective extraction procedures, separation and characterization procedures, employing such techniques as chromatography and molecular spectroscopy and wet chemical methods will be used to develop new and improved procedures for analyzing fiber components in foods.

o Automated Analysis of Water-Soluble Vitamins in Foods

Studies have been developed for rapid-automated analysis of the different forms of vitamin B_6, and C in foods. The extraction of the high pressure liquid chromatography (HPLC) procedures developed for thiamine have been applied to a number of foods. A HPLC procedure has been developed for the separation and quantitation of ascorbic acid and isoascorbic acid in foods. Studies are underway to devise appropriate procedures to measure the different forms of folate in foods.

o Effects of Low and Medium Dose Irradiation on Vitamin Content of Pork and Poultry Products

Protocols for response surface analysis of the effects of ionizing radiation on the vitamin contents of refrigerated pork and poultry have been developed. Pork chops and chicken breasts were subjected to radiation doses of 0, 50 (pork only), 175, 350, 525 or 700 kilorads at temperatures of -20^{o}, -10^{o}, 0^{o}, and 10^{o} and 20^{o}C. Vitamins to be measured include thiamin, riboflavin, niacin, pyridoxine, and vitamin B-12.

o Trace Mineral Absorption and Retention in Lactating Women

The absorption and retention of the trace elements copper, chromium, selenium, and zinc will be assessed by the use of stable non-radioactive isotopes in a group of lactating postpartum women, a group of formula feeding postpartum women and a group of never pregnant women. Blood, urine, and milk samples

will be analyzed for the uptake and retention of the stable isotopes of the above mentioned trace elements. Fecal samples will be analyzed for the copper, selenium, and zinc stable isotopes to determine the absorption of these trace elements.

o Bioavailability of Nutrients in the Elderly

Using animal models and human subjects, the effect of atrophic gastritis on the absorption of calcium, folacin, and vitamin B-12 will be measured. In addition, such factors as fiber or fat influence on absorption of nutrients such as vitamin A and pyridoxine will be studied.

o Mineral Bioavailability and Requirements in Humans

Studies are underway to assess the absorption and utilization of zinc, copper, iron, calcium, and magnesium in adult humans using stable non-radioactive isotopes. It has been found that zinc absorption is much less efficient in the elderly although 15 milligrams of zinc daily is adequate for both young and old adults. Zinc was not found to inhibit copper absorption at the recommended level of intake. Nor did a high level of vitamin C intake (600 mg/day) inhibit copper absorption. Copper aborption was observed to vary from 75% to 12%, as the level ingested per day was increased from 0.6 mg to 8.0 mg, respectively.

2. Research Highlights

o Food Composition

USDA continues to maintain tables on nutrient composition of foods. These tables are widely recognized and used throughout the world. The National Nutrient Data Bank (NNDB) has been expanded to include results from new analyses conducted by industry, government, universities, and from extramural studies funded by HNIS to fill data gaps. Products of the NNDB are reference values for over 60 food components in thousands of foods Americans consume. They are presented in published and machine readable forms for a variety of uses and users. Of special importance are the data bases prepared for use in assessing the nutrient content of diets reported in large scale surveys conducted by HNIS and by the National Center for Health Statistics (NCHS) in DHHS. A Memorandum of Understanding between HNIS and NCHS signed this year defines cooperation in this area.

Suitable methods have been developed for sampling and analyzing those foods that provide important amounts of nutrients to diets of Americans. The marked increase in number of processed foods, changes in consumer practices, and the need to have more specific information about components in foods (including fatty acids, carotenoids, and dietary fiber) has required increased effort.

o Nutrient Interactions

Research in humans has been initiated on interactions of nutrients with other components in foods and the effect on availability for absorption and use by the body. This research has included the effects of fiber, phytate, and oxalate found in foods on the availability of calcium, iron, zinc, and copper. In addition, fructose, a simple sugar that occurs in fruits and honey, has been found to markedly exacerbate the effects of low copper levels, presumably by

rendering it less available for metabolism. This information is important in applying requirement data to individuals consuming different food mixtures.

o Copper Fructose-Sex Interaction

Scientists at the Beltsville Human Nutrition Research Center have found that the feeding of fructose, but not glucose or starch, greatly exacerbates the symptoms associated with a copper deficiency in male rats. The most dramatic sign of copper deficiency in male rats fed diets high in fructose is sudden death due to rupture of the heart. A study was conducted with female, as well as male rats, to determine if females might be less affected, since human premenopausal women have a lower incidence of heart-related abnormalities. Mortality occurred only in the male rats fed the fructose diet low in copper, with 40% dying during the 8-week study. Plasma ceruloplasmin activity, erythrocyte superoxide dismutase activity, and hepatic copper concentrations were reduced to a similar extent in all rats, regardless of sex or type of dietary carbohydrate fed. The results suggest that female rats are apparently protected from the lethal consequences of a fructose copper deficient diet observed in their male counterparts. Also, feeding rats diets with fructose in place of starch increased by 3-fold the level of dietary copper required for a normal immune response.

o Copper-Vitamin Interaction Studied

Studies conducted with women between the ages of 18 and 36, housed in a metabolic unit and fed diets containing from 0.67, 1.47 and 2.67 milligrams of copper with 90 and 1,500 milligrams of vitamin C per day at the Grand Forks Human Nutrition Research Center revealed no differences in copper or iron balances. It was found that the specific activity of ceruloplasmin, diamine oxidase and the activity of cytochrome-C oxidase in platelets and mononucleated white cells are more sensitive indicators of copper status than plasma copper or erythrocyte superoxide dismutase, and that vitamin C supplements do not markedly affect commonly measured indices of iron and copper.

3. Other Research Activities and Findings

a. Research to Improve Foods for Use in Overseas Distribution Programs (ARS, OICD)

USDA procures approximately two million tons per year of agricultural commodities which are shipped overseas through PL-480, Title II, for use in emergency relief and nutrition oriented feeding programs. Many of the commodities are fortified with protein, vitamins and minerals to help alleviate known nutrient deficiencies among the food recipients.

Recent research in Indonesia suggests that vitamin A is of greater significance than previously believed in reducing morbidity and mortality among young children. Based on these findings, USDA, working in cooperation with the U.S. Agency for International Development, has examined additional foods which can serve as carriers for vitamin A. As a result, soy fortified bulgar wheat and sorghum grits, which are distributed through PL-480, Title II, are now fortified with vitamin A, as well as other vitamins and minerals, and research is being undertaken to explore fortification of wheat distributed by the U.S. in Bangladesh. A new commodity, instant corn-soya-masa flour, which is fortified with vitamin A and other

micronutrients, has also been programmed for distribution this year. In addition, vitamin A fortification of foods processed in developing countries, including rice and monosodium glutamate (MSG), is under study through USDA's Office of International Cooperation and Development.

b. Research to Provide Food Composition Data Bases (HNIS)

o Composition of Legumes and Fish

New data on the composition of legumes and legume products and of finfish and shellfish were compiled, evaluated, and used to revise values published in "Composition of Foods...Raw, Processed, Prepared," Agricultural Handbook No. 8 (AH-8). Values were published in two revised sections (AH 8-15 and AH 8-16). Computerized data sets for the new sections were issued and the Nutrient Data Base for Standard Reference was revised accordingly.

o Sugar Content

"Sugar Content of Selected Foods: Individual and Total Sugars," Home Economics Research Report No. 48, presents newly compiled data on simple and complex sugar fractions, as well as total sugar contents for over 500 food items. This is the first comprehensive table of the sugar content of American foods.

o Special Data Bases Prepared

Special data bases for use in assessing the content of food energy and 27 nutrients in diets reported in the Nationwide Food Consumption Survey 1987 were prepared. They incorporated current information on composition of edible parts of foods as purchased by households (the household data base) and foods as eaten at home and away from home by individuals (the individual data base). Data bases have been expanded since the last large survey in 1977-78 from 14 to 27 food components. The new data bases include several components currently of interest to nutritionists, such as fatty acids, cholesterol, dietary fiber, sodium, zinc, copper, carotenoids, vitamin E, and folacin. Values have been revised to reflect new and improved data (iron content of meat is somewhat lower than previously released, for example) and changes in foods marketed (examples are changes due to changes in enrichment standards and fortification levels, lower fat meats, changes in the fat trim and meats marketed, and carrot species with higher vitamin A content.) If analytical data were not available for a food in these data bases, values were inputed by HNIS scientists. Data tapes will be available for public use.

- Analyses were conducted to fill data gaps, especially on the composition of foods newly marketed or reported as consumed in national surveys. Examples are foods from fish fast food establishments, Mexican fast foods, fried chicken fast food establishments, and other fast food items; frozen prepared foods, cereal products and selected baked products, and raw and cooked mixed dishes.

- Food components receiving emphasis in extramural analyses were those believed to be important to health promotion and disease prevention for which data were insufficient to assess diets. For example, the carotenoid

content of raw fruits and vegetables was determined and nutrient analyses of carbohydrate fractions in selected foods of plant origin were conducted. Studies of the selenium content of foods are underway.

- The adequacy of analytical data for assessing diets reported in 1985 food intake surveys was studied. The number of the several thousand food items that provided 80 percent of total intake varied by nutrient--from 33 for carotene to 217 for iron. Of the items covering 80 percent of intake, the percentage with values inputed by HNIS scientists because analytical data were unavailable varied: none for carotene, 10 percent for iron, 38 percent for dietary fiber, and 50 percent for vitamin E.

- HNIS scientists presented papers on their research and other NNDB activities at the Twelfth National Data Bank Conference and other national and international meetings, including INFOODS and the International Symposium on Horticulture and Human Health.

c. Research on Bioavailability and Interactions (ARS)

o Low-Copper-Fructose Interaction in Pigs

Beltsville scientists have evaluated the young pig as an alternate animal model for studying the low copper-fructose dietary interaction. Young pigs fed a semipurified low-copper diet containing 20% of calories from fructose exhibited marked lesions including a doubling in heart size in relation to body weight, increased liver iron, and histological changes in heart muscle. These lesions were prevented when glucose replaced fructose in the low-copper diet or when adequate copper was added. Studies aimed at elucidating the effects of dietary copper and carbohydrate on the expression of genes coding for proteins that function in the transport and storage of copper and iron have been initiated.

o Selenium Bioavailability

Selenium from wheat that was fertilized with selenium during growth (as occurs in Finland) is as available as selenium in unfertilized wheat. Bioavailability is measured by the ability of the grain to normalize rat hepatic glutathione peroxidase in deficient rats.

o Interactions of Dietary Fiber with Food Nutrients

Calcium pectate gels, under physiological conditions, bind bile acids similar to carrot residue cell wall material. Thus, pectin in both natural and processed forms can lower blood cholesterol. Pectin also was found to inhibit the precipitation of calcium phytate, promoting mineral bioavailability. Pectin inhibits the formation of fatty acid calcium salts as well. Pectin also increased the viscosity of the contents of the intestional tract which may partially explain the reduced rate of stomach emptying, digestion and absorption. Other studies have been conducted with cellulose, hemicellulose and fiber from fruits and vegetables.

o Iron Bioavailability from Soy Hulls

Iron in soy hulls, intrinsically or extrinsically labeled with ^{59}Fe, was found to be as effectively absorbed by human volunteers as bakery grade ferrous sulfate used for enrichment of bread. The soy hulls were incorporated

into rolls served in a meal to the volunteers. This finding indicates that soy hulls could be used as a suitable iron source in human diets in contrast to wheat bran which reduced the bioavailability of iron, zinc, and calcium.

d. Other Food Composition Related Research (ARS)

o Automated Carotenoid Analysis of Foods

Automated and computerized methods to improve precision and accuracy of the analysis of carotenoids in foods were developed. Major carotenoids from five different vegetables (broccoli, cabbage, spinach, brussel sprouts, and kale) were separated, identified and quantitated using a variety of techniques. The abundant carotenoids present were neoxanthin, violaxanthin, lutein epoxide, lutein, beta-carotene and all-trans-lutein. Mild cooking (6 minutes in microwave oven) drastically reduced (30-40%) total carotenoid content of brussel sprouts and kale.

o Reference Standards Developed

Certified standard reference materials of known nutrient contents (mixed diet and bovine serum) have been prepared and turned over to the National Bureau of Standards. These reference materials have been distributed worldwide.

o Nutrient Composition Data

The Beltsville Human Nutrition Research Center's Nutrient Composition Laboratory provides essential data on the nutrient content of food by (1) developing appropriate methods for analysis of nutrients in foods; (2) developing sound sampling techniques to ensure that representative samples are analyzed; (3) analyzing the nutrient content of foods with tested, dependable assay techniques; and (4) conducting research on the effect of food processing, storage, and marketing methods, as well as home, institutional, and restaurant food preparation procedures on nutrient composition.

D. Food and Nutrition Monitoring Research

Food consumption by Americans was monitored and their diets were assessed for nutrient content as part of the National Nutrition Monitoring System (NNMS). Of the five major NNMS categories, USDA's role is prominent in three: food composition measurements (section C), food supply determinants (this section and section F) and food consumption measurements (this section). The Joint Operational Plan for the National Nutrition Monitoring System from 1987 to 1996 was sent to Congress. The Plan sets goals for the system, summarizes recent progress, and outlines plans (See D.2.b).

1. U.S. Food and Nutrient Supplies (ERS, HNIS)

o Estimated Per Capita Food Supplies

The estimates of per capita food supplies and their nutrient content for the year 1985 were added to the historical series of annual estimates since 1909. Almost all nutrients in the 1985 food supply were slightly higher than a year earlier. Largest increases were in fat (up 5 percent) and vitamin E (up 7 percent), primarily due to increased supplies of salad and cooking oils. Over the past two decades vitamin A supplies increased by over one-third, mainly

reflecting increased supplies of dark-green and deep-yellow vegetables but also higher values of the new deeper orange colored carrots and sweet potatoes now marketed.

o Russian Food Supplies Calculated

The nutrient content of Russian food supplies was evaluated and compared with those of the United States.

2. Food Consumption Surveys (HNIS)

a. Methodological Research

(1) Research Highlights

o Research to improve the efficiency of surveys and accuracy of data has been sponsored by HNIS during the past decade. During the past year, efforts focused on bringing results of this research to the food, nutrition, and health communities through a symposium at the 71st Annual Meeting of the Federation of American Societies for Experimental Biology; participation in the third conference for Federally Supported Human Nutrition Research Units and Centers, and the Conference of the Association of State and Territorial Public Health Nutrition Directors; and preparation of a source book on the research, which is undergoing peer review. Experience gained during the last decade has confirmed the choice of the 3-consecutive-day dietary data collection methodology for use in the Nationwide Food Consumption Surveys (NFCS) and justified the methods used in the panel studies conducted as the Continuing Surveys of Food Intakes by Individuals (CSFII) in 1985 and 1986. Other research results indicated the need for further exploration. Results were reported in 1987 (HNIS Administrative Report No. 382).

(2) Research Findings

o M. A. Caliendo, University of Maryland, evaluated the validity of food recall information on diets of men with respect to men's ability to recall prior day's intake, effectiveness of measuring utensils and models as measurement aids, problem foods, and surrogate respondents. Men recalled about 85 percent of items actually eaten (unobtrusively observed). Errors of omission were more frequent than errors of addition. The measurement aids studied are used differently and are not interchangeable.

o A data collection contractor evaluated for completion rates, data quality, respondent burden, and processing, eight different approaches for collecting panel data--respondents recontacted several times during one year. Of the approaches, which involved collection by personal interview, telephone, mail, and combinations of these, the approach with the highest overall rating was an initial in-person contact to get a 24-hour recall and subsequent 24-hour recalls by telephone or in person if respondent has no phone.

o K. J. Morgan et al. evaluated effects of number of days intakes and methods of recording on intake levels using 12 days of data (3 consecutive days in 4 quarters of year) from the study described above. Benefits of additional days of intake were found to fall off importantly after 6 days.

- Another data collection contractor identified special problems of collecting panel data in the low-income population. Procedures that involved mail-in records, collection of data for more than a few days, and dependency on telephones were unsatisfactory.

- S. R. Johnson et al. established fundamental relationships between intakes of female household heads and other household members in 14 sex-age groups from NFCS 1977-78. Mean intakes by groups of female heads were strongly related to intakes by groups of other household members for 3 food components examined. Explanatory power was greater for groups 10 years and under and males 19 and over, but less for 11 to 18 year age groups.

- The HNIS-funded National Academy of Sciences (NAS) report "Nutrient Adequacy: Assessment using Food Consumption Surveys", 1986, made these recommendations: (1) develop multiple criteria of nutritional adequacy; (2) adopt a probability approach where feasible for analysis; and (3) use descriptive presentation of mean, variance and percentile distributions when no probability assessment can be made. The following steps have been taken: (1) the NAS has been requested to develop the multiple criteria required; (2) the inter- and intra-variability in dietary data from CSFII 1985 is being studied by Iowa State University and the University of Arizona; and (3) NFCS 1987 descriptive results will be presented as recommended.

- F. A. Larkin, University of Michigan, developed a 1-year retrospective food frequency questionnaire and studied the validity of results against mean results from 16 single days' data collected by recall and records. The frequency questionnaire overestimates intake compared to recall/record values. No one factor was identified to explain good or poor agreement between methods.

- L. Hoover, University of Missouri, studied consequences of using a nutrient data base of fewer foods in assessing nutrient content of diets for groups of individuals reported in surveys. Either a large data base of several thousand foods or a shortened data base tailored to consumption practices appears necessary. It is not clear that a shortened data base is cost effective because making substitutions may take as much time as coding foods from the longer list.

- Using ARS dietary intake data for 29 people for 365 consecutive days, P. Basiotis found the number of days of records required to "accurately" estimate individual and group intakes to vary widely by nutrient. Three days of intake were adequate for group estimates for most nutrients.

- The response by women 19-50 years in CSFII-85's panel approach of 6 contacts (one in person, the rest by telephone, if available) at about 2-month intervals was studied. Women tending to respond on more contacts were in nonmetropolitan areas, were in food assistance programs, had higher body mass index, were older, were in good to excellent health, had shorter first interviews and had subsequent interviews by telephone.

- A system for the use of lap-top microcomputers for the recording of certain data collected by interview in households in national surveys was developed, tested, and used in NFCS 1987. Data included demographic and other characteristics of households and individuals and recalls of household consumption during the 7-day period prior to the interview.

- Attempts to assess the effects of methodological and data base changes between 1977 and 1985 have not been totally successful. Problems occur because behavior change and methods change effects cannot be clearly separated and data base changes resulting from improved data and from real changes in foods cannot always be separated. Therefore, a "bridging" survey has been planned in which comparable samples of women will respond to surveys with two sets of procedures, one used in 1977 and one used in 1987, to help determine what, if any, method effects exist.

b. Collecting and Reporting of Survey Data (HNIS)

(1) Research highlights

- Survey activities were in three main areas: (1) preparation, documentation and release of public use data tapes and reporting of descriptive tabular results from the Continuing Survey of Food Intakes by Individuals (CSFII) in 1985 and in 1986; (2) launching and supporting technical aspects of data collection for the larger Nationwide Food Consumption Survey, 1987 (NFCS 1987) of household food use and food costs and food intakes at home and away by individual household members; and (3) planning for future activities conducted as part of the National Nutrition Monitoring System (NNMS).

(2) Research Activities and Findings

- CSFII. Five statistical reports and numerous articles and papers described the food and nutrient intakes and dietary practices by national samples of women and men 19-50 years and 1-5-year-old children. "Usual" diets as measured by 4 nonconsecutive days at 2-or-more-month intervals showed mean nutrient intakes by women, regardless of region or income, to be well below RDA for 6 nutrients: calcium, iron, zinc, magnesium, folacin, vitamin B-6. Fat provided less than 35 percent of energy in 33 percent of the women's intakes and less than 30 percent of energy in 12 percent of intakes. Women's mean cholesterol intakes were 300 mg/day and men's were 440 mg/day. Dietary fiber levels were 12 grams per day for women and 18 grams per day for men. Snacks and food away from home made major contributions of energy and of essential nutrients to diets of women, men, and children. Compared with NFCS 1977, 1985 food intakes by women were higher by 60 percent in skim and lowfat milk, 53 percent in soft drinks, 35 percent in mixtures mainly meat, poultry, and fish; 29 percent in grain products. They were lower by 35 percent in whole milk, 34 percent in meat reported separately and 28 percent in eggs. Generally, women with higher incomes and education were leaders in these consumption changes.

- o NFCS 1987. A year-long survey of 6,000 households in 118 sampling areas in the 48 mainland States began April 1, 1987. Data are being collected by National Analysts Division of Booz, Allen and Hamilton, Inc. HNIS staff developed the survey instruments working closely with data users to maximize data usefulness and with other data providers to assure comparability or linkages to other sources of food and nutrition-related data. Over 100 individuals and groups who use or provide data were asked to peer review the survey design and instruments. Technical food information support files (food codes, volume-weight conversions, default values, and nutrient data) were updated. Microcomputers are being used to record major portions of the interview. A total of 14 5-day training sessions were held for interviewers and reviewers in Philadelphia, Chicago, and Los Angeles, and 2 sessions for food coders in Philadelphia with HNIS evaluators in attendance. Staff from USDA's FNS, from NCHS, and from USDA's the National Agricultural Statistical Service (NASS) observed the training. NASS, under special agreement, is cooperating actively in all aspects of survey planning and methodological development. All aspects of the sampling and data collection are being monitored by HNIS staff.

- o NNMS plans. The CSFII 1985 and 1986 and NFCS 1987 are major components of the NNMS. An Operational Plan for NNMS from 1987 to 1996 was prepared under the direction of the Assistant Secretaries for Health (DHHS) and for Food and Consumer Services (USDA). The Plan's Calendar of Events highlights plans for monitoring activities into the mid-1990's by the two departments. USDA's role involves the following:

  - Annual estimates of the food and nutrient content of U.S. per capita food supplies.

  - Continuation of food composition research and measurements by HNIS and ARS.

  - Reinstatement of a modified CSFII after NFCS 1987 data collection ends in 1988. CSFII of 1989 and each year through 1996 will obtain 3 days food intake data from all members in 1,500 households in the general population and an additional 750 households in the low-income population for a total of about 6,000 individuals each year. Results will be published annually using a moving average approach.

  - CSFII followup telephone interview on consumers' attitudes and perceptions on diet/health issues (HNIS, FSIS, and FDA). This information will allow, for the first time, analyses to study links between attitudes about diet and dietary consumption on a national basis.

  - CSFII's yearly surveys provide a potential for add-ons to study populations at nutritional risk. Such an add-on to study diets of the low-income elderly is planned for 1990.

3. Dietary Assessment Research (HNIS, ARS)

- o Dietary status for the population as indicated by the nutrient content of per capita food supplies, the nutrient levels of food used by U.S. households and the nutrient intakes from food eaten at home and away by individuals was studied by the Joint Nutrition Monitoring Evaluation Committee and reported to the Congress in Nutrition Monitoring in the

United States in July 1986. (Results were summarized in the "USDA Comprehensive Plan for a National Food and Human Nutrition Research and Education Program: A Report to Congress," pages 83-85). The review and scientific interpretation for the second report, to be completed in 1989, will be prepared under contract by a scientific organization funded jointly by USDA and DHHS. The scope and emphasis of the report was defined and the contractor selected in 1987. Agencies conducting monitoring activities will provide the contractor with tabular and analytical results from surveys and results from methodological research for use in the report. New information on dietary status since the 1986 report on dietary status will focus on CSFII results (D.2.b. reported above and D.4 reported below).

- A computerized food scale system has been developed at USDA Western Human Nutrition Center to quantitate dietary intake of individuals in clinical studies. The system consists of a portable computer linked to an electronic scale and a bar code reader. The bar code reader is used to input food identification information from a food dictionary. Menu driven computer software has been developed to prompt the research subject through the procedures for recording food intake. Upon completion of data collection, stored food intake data are directly transferred to a microcomputer for editing and for conversion to nutrient intake. This system has been designed to allow for simple in-home food consumption measurement as well as rapid data processing. A prototype system has been developed and is currently being tested in the laboratory.

4. Determinants of Dietary Status Research (HNIS)

- Eight cooperative agreements were awarded to analyze CSFII-85 data to determine the personal, demographic, and household characteristics affecting dietary status measured in terms of foods and food groups and of nutrients and other food components and to determine the effect of food consumption patterns, eating patterns and health-related factors on dietary status. Research will involve 6 days' dietary data for the general and low-income populations in 1985 and 3 days' data in 1977-78. HNIS staff conducted a 3-day orientation conference for investigators and HNIS scientists are working cooperatively with investigators to assure maximum coordination among investigators and usefulness of results to USDA and HNIS. Findings from these investigations will be reported at scientific meetings, published in refereed journals and provided for use in the second report of NNMS to Congress in 1989.

5. Nutritional Status Assessment Research (ARS)

- The Western Human Nutrition Research Center at Letterman Army Institute of Research, San Francisco, CA, conducts research on improved methods for assessing human nutritional status. The Center focuses on (1) identification of factors which result in malnutrition, (2) development of reliable and efficient methods for defining nutritional status, (3) determining nutritional requirements, and (4) developing nutritional criteria and methodologies to assist in design and evaluation of nutrition action programs. Improved automated methodologies have been devised for measuring riboflavin, pyridoxine, and vitamin C status. High pressure liquid chromotography is used to measure iso-ascorbic acid levels. Rapid and accurate methods for measuring body composition also have been developed and tested.

- The Human Nutrition Research Center on Aging at Tufts University, Boston, MA, has developed an improved method of measuring vitamin K status and conducted as assessment of the nutritional status of 700 non-institutionalized and 260 institutionalized elderly in the Boston area.

- Scientists at the Children's Nutrition Research Center have devised new methods for measuring body protein and fat in infants.

- An improved method for assessing the vitamin E status, using platelets, has been developed at the Beltsville Human Nutrition Research Center.

E. Food and Nutrition Information and Education Research

This research includes studies of dietary practices, food consumption patterns and their determinants (some described in D.4 above) as well as studies of methods and strategies for informing and educating consumers and professionals who serve them about nutrition, health, and dietary practices. Research attempts to answer questions about appropriate dietary guidelines and information needed to help the public understand and meet the guidelines and techniques most appropriate for communicating this information.

1. Establishing Dietary Guidance Policy (HNIS)

- In support of the Dietary Guidelines for Americans, research efforts underway or planned include a study of non-Federal professionals' awareness and uses of the bulletin. In addition, a study of individuals' cognitive responses to the bulletin and information it contains is planned. Also, a survey underway of persons requesting free copies of the bulletin from the Consumer Information Center will provide information about reactions by and characteristics of this type user.

- A computerized system to assess the practicality of quantitative dietary recommendations of authoritative groups was developed and demonstrated at a national meeting. Certain quantitative recommendations for dietary components, established by authoritative groups such as the National Academy of Sciences (NAS), the National Cancer Institute (NCI), the National Heart, Lung and Blood Institute (NHLBI), are met by few diets reported in national surveys. The HNIS system objectively determines the dietary changes to food consumption pattern identified from national surveys required to meet all recommendations for dietary components specified.

- Meeting recommendations by the American Heart Association (AHA) in December 1986 of less than 100 mg of cholesterol per 1,000 kcal and 30 percent of kcal from fat, with or without RDA for vitamins and minerals, was shown to require dietary changes by women 19-50 years believed to be beyond changes women might make. Even more difficult to meet is the AHA guideline of 1 gm sodium per 1,000 kcal--a level achieved by no women surveyed in 1985.

2. Food and Nutrition Materials (HNIS)

- Most materials developed in 1987 interpret concepts in the Dietary Guidelines and results from USDA research on food composition, food selection, handling and storage, and food money management. Target audiences are groups of food and nutrition professionals, such as home economics teachers, Extension agents, and public health professionals who work with the general public, low-income groups, and consumers with special interest in food and nutrition.

- Two nutrition education research projects were completed and reported. One evaluated a nutrition pamphlet developed for and with the involvement of low-income, low-literacy adults. The other employed new research approaches in evaluating print materials for consumers.

- Examples of materials developed and/or released in 1987 are as follows:

  - A "Dietary Guidelines Teaching Kit" for use by home economics teachers was developed. It contains the Dietary Guidelines bulletin, "Dietary Guidelines and Your Diet", seven small bulletins--one for each of the 7 Guidelines--developed in 1986 to supplement information in the Guidelines bulletin, and a "Home Economics Teachers' Guide." A panel of teachers and an author of home economics textbooks helped prepare the Guide, which contains lesson plans with suggestions for student activities and reproducible materials for classroom use. Copies of the Kit will be made available free of charge to home economics teachers.

  - A second set of seven small bulletins to help the public put the Guidelines into practice (while planning menus, shopping for food, preparing food, eating out, making bag lunches, making quick meals, and selecting snacks) were developed and are undergoing formative evaluation.

  - A prototype microcomputer program for dietary analysis for use by consumers in Extension Service education programs was developed, presented at two professional meetings, and is being pilot-tested by Extension specialists. The user-friendly system accepts information about 1 to 3 days' food intake and presents information on the content of the diet in terms of 28 nutrients and food components in bar graphs. When perfected, the software and data bases will be made available through the National Technical Information Service.

  - The cost of food at home in food plans at four cost levels--thrifty, low-cost, moderate-cost, and liberal--was estimated and released monthly in press releases and other formats. The cost of food in the thrifty food plan for the 4-person household used by the Department in setting benefits for the Food Stamp Program increased 6.8 percent between June 1986 and June 1987.

- A study of the food sources of calcium and their costs was reported in Family Economics Review--a USDA periodical directed primarily to Extension agents. The comparative costs of meat and meat alternates as sources of protein were estimated in February and in September, and issued in press releases. Of foods studied, the most economical food sources of calcium were dry and fluid milk and calcium-fortified bread; the most economical sources of protein were eggs, beef liver, and peanut butter. Ground beef, whole chicken and turkey, and canned tuna were also economical as protein sources.

- "Cooking for People with Food Allergies," USDA Home and Garden Bulletin No. 246, presents standardized cooking procedures and recipes appropriate for people with allergic conditions.

3. Research Support Activities

The Food and Nutrition Information Center (FNIC) of the NAL supports the research activities of USDA and other scientists primarily through the provision of reference services and literature searches utilizing online bibliographic databases, such as NAL's AGRICOLA database.

F. Research on Government Policies and Socioeconomic Factors (FNS, ERS, AMS)

1. Research Initiated

o Breastfeeding Promotion Study

Federal requirements for the Supplemental Food Program for Women, Infants and Children (WIC) include provisions to encourage breastfeeding. Because little is known about the most effective methods to promote breastfeeding in the WIC population, the Food and Nutrition Service (FNS) is conducting the WIC Breastfeeding Promotion Study in FY 1987. The purpose of this study is to identify and evaluate education models for effective breastfeeding promotion. These models will be used to provide technical assistance to State and local WIC agencies in their efforts to increase the proportion of WIC women who breastfeed.

o Analysis of the Dietary Impact of FNS Programs

FNS is analyzing data from USDA's Continuing Survey of Food Intakes of Individuals to assess the impact FNS' programs have on the dietary intake and food expenditure patterns of participants. In addition to studying how program participation may directly affect dietary intake, FNS is interested in learning of any indirect effect on a non-participating household member resulting from someone in the household participating in an FNS program. Analyses also include examining participants' and non-participants' at-home and away-from-home food expenditure patterns.

o Consumer Demand for Fresh Fruits and Vegetables Studied

An award was made to the Virginia Department of Agriculture through the Federal-State Marketing Improvement Program to assess the demand for fresh fruits and vegetables by non-commercial establishments, such as public school

districts and post secondary institutions. The purpose of the study is to determine the volume and kind of fresh fruits and vegetables consumed by non-commercial establishments and to identify and evaluate the factors entering into a person's decision-making process when purchasing fruits and vegetables.

o The Supplemental Food Program for Women, Infants and Children (WIC) Analytic Research Projects

This FNS research focuses on a number of specific and ad hoc policy relevant analyses using data primarily from the WIC Program and Participant Characteristics Study and the National WIC Evaluation. This research should expand present knowledge about the effectiveness of the WIC Program and provide more insight on program and participant characteristics. Examples of topics to be examined are characteristics of WIC households, food consumption patterns of WIC participants, and program factors associated with providing benefits to those most in need.

2. Other Findings

o Dietary Impacts of the School Breakfast Program

This recently released FNS study examined the intake of various nutrients, the likelihood of eating any breakfast, and the types and quantitites of foods eaten by both participants of the School Breakfast Program (SBP) and non-participants. The following are some of the major findings:

- Participation in SBP has no significant relationship with the proportion of total food energy obtained from protein, fat, or carbohydrate.

- Students 5 to 14 years of age who participate in SBP consume less cholesterol than nonparticipants.

- Calcium intake and the likelihood of meeting the RDA for calcium are, in general, positively associated with SBP participation.

- Iron intake at breakfast is negatively related to SBP participation, although the likelihood for meeting the RDA for iron does not appear to differ between participants and non-participants, except for older teenagers.

- The likelihood of eating any breakfast is not related to the SBP.

- Of the three daily meals, breakfast is the most important predictor of daily nutrient intake and whether the RDA's are met. Eating any breakfast has a significant, positive impact on the daily intake of food energy and vitamin B6, vitamin A, iron, calcium, and magnesium.

o The Sodium and Micro-nutrient Content of USDA School Lunches

This FNS study examined the effects of the National School Lunch Program (NSLP) on students' dietary intake of food energy, sodium, protein, fat and carbohydrate. Some of the major findings are:

- The lunch intake of protein by most NSLP participants is greater than that of students who eat alternative lunches.

- Female students 5 to 15 years of age experience the greatest number of significant NSLP effects on macro-nutrient intake. For both female and male students 15 to 21 years of age, there are very few differences between NSLP participants and students who eat alternative lunches for the lunch intake of food energy, sodium, protein, fat, and carbohydrate.

- There are virtually no differences in the amounts eaten at lunch by NSLP participants and non-participants, among male students of all ages.

- In no age-sex category do NSLP participants and students who eat other lunches differ in 24-hour food energy intake.

- NSLP participants have greater lunch intakes of food energy, protein, and eight micro-nutrients than do students who eat other lunches.

o The Food Choices of Low-Income Households

This FNS study involved a descriptive analysis of data from the 1977-78 Nationwide Food Consumption Survey on household food use by low-income households. Findings suggest that the quantity of food used is the primary factor differentiating households as to whether or not they achieve the Recommended Dietary Allowances (RDA). Two findings concerning Food Stamp Program (FSP) households are:

- Proportionately more FSP households than non-participating low-income households achieved 100 percent of the RDA for 11 nutrients studied.

- The food use by FSP households and low-income non-participating households was generally similar with respect to both the quantities of food used and the share of food dollars allocated to 31 food groups studied. The exceptions were red meat and eggs, which were used in larger quantities by some FSP households.

o Studies on Food Prices and Consumer Demand

ERS conducted research on the effects of advertising and promotion on the demand for cheese. During the 22-month period between September 1984 and June 1986, increased generic advertising by the National Dairy Promotion and Research Board and regional organizations of $94.7 million was found to have increased national at-home consumption of natural cheese by 12.6 million pounds and processed cheese by 38.2 million pounds.

ERS conducted research on the frequency of purchase of selected foods and changing patterns of household food expenditures. Average weekly total food expenditures rose from $21.55 per person in 1982 to $22.55 in 1984. Per person spending for food consumed at home increased from 1982-84 but not as much as per person spending on food away from home.

ERS completed a study which finds that differing supermarket prices and household purchase practices can affect real food stamp benefits. Within cities, supermarket prices typically vary by up to 7 percent, with extremes of up to 25 percent. Regional supermarket price indexes are not better than

national indices, because price differences do not show regional patterns. Instead, price differences are store specific and reflect store costs, neighborhood characteristics, and company strategies. Low-income households do not necessarily pay higher prices. Actual household purchase practices do differ from government recommendations, and raise household food costs by five to eight percent, compared to the cost of the recommended diet.

III. USDA FOOD AND NUTRITION INFORMATION AND EDUCATION PROGRAMS

In 1987 the eight or more separate USDA agencies largely responsible for food and nutrition information and education continued programs to meet their clients' needs. Improved communication and cooperation among agencies on information and education projects was promoted especially by the Subcommittee for Human Nutrition of the Committee on Research and Education and by the Assistant Secretaries for Food and Consumer Services and for Science and Education.

A. Current Program Parameters

1. Ongoing Food and Nutrition Information and Education Activities

USDA agencies and their primary food and nutrition information and education responsibilities are listed below.

- Food, nutrition and health programs continue to be a major program emphasis within Cooperative Extension Service. Each year, approximately 10-12 million people participated in this educational program. Additional people were reached through mass media efforts. In addition, approximately one third of all 4-H members have food and nutrition projects. All 50 states and 5 territories support major programs in food, nutrition and health. In addition, every county home economics program includes a food, nutrition and health component.

  People of all age groups and income levels participate in Extension food, nutrition and health programs. The Dietary Guidelines in conjunction with research based information serve as the bases for developing program content. Programs are designed to assist consumers in making sound decisions that can positively affect their quality of life. Major program emphases are nutrient needs throughout the life cycle, the relationship of diet and fitness to overall health and well-being, evaluation of nutrition information, management of food resources, and understanding the factors that affect food quality.

- The Extension Service (ES) operates Food and Nutrition Education Programs in partnership with the Cooperative Extension System to disseminate knowledge and applied research directly to the general public. ES also operates the Expanded Food and Nutrition Education Program (EFNEP), a mandated program for low income families and youth.

- The Human Nutrition Information Service (HNIS) coordinates Federal dietary guidance policy, develops research-based dietary guidance materials for the general public, and reports results from its research in food composition, food consumption, and nutrition education to professionals.

- The National Agricultural Library (NAL), through its Food and Nutrition Information Center (FNIC), collects and disseminates information on a wide range of nutrition topics and accumulates and loans nutrition education materials to educators.

- The Agricultural Research Service (ARS) and the Cooperative State Research Service (CSRS) report results from their programs of food and nutrition research usually to professional audiences.

- The Food Safety and Inspection Service (FSIS) is responsible for the safety, wholesomeness and accurate labeling of meat and poultry products and for informing the public on safe handling of these foods.

- The Agricultural Marketing Service (AMS) is responsible for the grading of foods and for the accuracy of promotional materials of some commodity groups.

- The Food and Nutrition Service (FNS) supports the nutrition education components of food assistance programs they administer--Child Nutrition, WIC, Food Stamp.

- Office of Governmental and Public Affairs (OGPA) provides review and coordination of all food and nutrition information disseminated by USDA.

2. New Initiatives

- Improving Nutrition, Diet, and Health Extension Thrust

"Improving Nutrition, Diet, and Health" has been selected as one of eight major initiatives of the Extension Service. The goal is to improve nutritional and health status of the population through nutrition education, resulting in the adoption of recommended dietary practices.

The development and implementation of a priority initiative will strengthen the coordination and focus the resources of the State Cooperative Extension in this area. Two critical issues have been identified for this initiative. These are: (1) Dietary practices relating to lifestyle factors and health problems such as infant mortality, low birth weights, obesity, chronic diseases and nutrition misinformation, inadequacies and abuses, and (2) Confidence in the safety, quality, and composition of the food supply. The two goals of this issue are: Improve the ability of consumers to make informed choices related to food safety, quality, and composition; and increase knowledge and improve understanding about the food system including its risks and benefits among consumers, policy makers, the media, and food producers, processors, and handlers while the system fulfills the consumers needs and perceptions. Extension centers of excellence are envisioned as a means of developing this initiative within available resources and personnel.

- Cross-Cultural Counseling Project

The Cross-Cultural Counseling Project began in 1986 to provide technical assistance to staff of the WIC Program and the Commodity Supplemental Feeding (CSF) Program in counseling a wide range of racial/ethnic groups. The project goal is to enhance the cross-cultural counseling skills of nutrition

counselors in the WIC and CSF programs in order to increase participant acceptability of the information presented. A technical assistance guide was developed jointly by the Food and Nutrition Service (FNS), USDA; and DHHS in 1986. In 1987 a video tape was developed by FNS to assist program staff when presenting the technical material in a workshop setting.

o Food Distribution Program on Indian Reservations

In 1985-1986, an FNS task force reviewed the Food Distribution Program on Indian Reservations (FDPIR) regulations and made recommendations for improving the food package and expanding nutrition education efforts.

In 1987, in response to task force recommendations, FNS decreased levels of fat and sugar; added several new foods to reflect nutritional needs and food preferences; increased the quantitites of several popular foods; and deleted several unpopular foods. FNS also is working with the Indian Health Service (IHS), the Extension Service, and the USDA Food and Nutrition Information Center (FNIC) to develop a set of bibliographies on information and resource materials of the health and culture of American Indians. The Extension Service cooperated with FNS in obtaining from State Cooperative Extension Service nutrition education materials used in delivering the program to Alaskan Natives and American Indians. The information contributed to the bibliography is utilized by mainly Extension professionals and paraprofessionals in teaching in the Expanded Food and Nutrition Education Program.

Additionally, FNS has begun several initiatives to address the recommendations for the nutrition education component. These include:

- Expanding FNIC service to FDPIR staff.

- Identifying nutrition education contacts in the Indian Tribal Organizations and State agencies who will help publicize FNIC services as well as receive nutrition education materials prepared.

- Working cooperatively with the Indian Health Service (IHS) and FNIC to develop an FDPIR nutrition education resource guide.

o Nutrition Education Resource Guide

FNIC has also initiated an update to the "Promoting Nutrition through Education: A Resource Guide to the Nutrition Education and Training Program (NET)." This update included food service training and nutrition education resources developed with NET support since 1984.

o Conference on Nutrition and Fitness Planned

A task group of the Subcommittee on Human Nutrition, chaired by Bonnie Tanner, ES, is planning a national conference on nutrition and fitness to be held in Washington, D.C. in March 1988. This conference is being coordinated with the USDA Interagency Committee on Food and Fitness and will be cosponsored by the President's Council on Physical Fitness and Sports.

o USDA Food and Fitness Program

The USDA Food and Fitness program is designed to increase public awareness of the abundance and variety of foods provided by American agriculture, and the

relationship of diet and exercise to good health. The program aims to encourage all Americans to use this bounty of food and physical fitness opportunities to their own advantage and health--every day. Twenty-two USDA agencies work together in planning and implementing this program at the national level and the Extension System coordinates and implements the program at the State and local level. All States and territories have identified State Food and Fitness Coordinators. Approximately 30 million adults and youth have been reached nationwide.

o Red Meat Project

USDA Extension Service has recently funded a project that will introduce a new process for program development of a consumer education program. The topic for this pilot project is red meat. The aspects that are unique are that the development process will include a multidisciplinary team of Meat Science and Food and Nutrition Extension Specialists from three different States--Florida, Kansas, and Texas. In addition, an advisory group of red meat industry representatives and end-users organizations will be formed to provide input and to react to the products that are developed. The anticipated benefits of this type of approach will be a more uniform approach to the controversial aspects of red meat, and the development of educational resources that have a national identity. It is anticipated that this will provide consumers with a much clearer description of red meat's role in a varied, balanced diet.

o Revision of USDA Publications of Food Safety/Preservation

ES-USDA has been working for several years with the Extension Center of Excellence for Food Safety and Preservation at Penn State University to develop the necessary data for revising four of the very popular USDA publications on food preservation. The four publications cover the canning of fruits and vegetables; canning of meats, poultry and fish; making jams and jellies; and making pickles. These publications stress the safety aspects of home food preservation which is needed to counter the vast amount of misinformation and unsafe practices which continue to be handed down from generation to generation. The publication date is expected to be late winter 1988.

Education materials in the form of newsletters, fact sheets, pamphlets, videotapes, slide/cassette sets and posters continue to be used in all states to educate consumers and institutional food handlers about safe food handling practices. The information relates ways to avoid contamination and cross-contamination with bacteria that cause foodborne disease. Dangerous pathogens such as Salmonella can exist on foods but not be harmful once consumers practice proper cooking procedures and sanitation practices. Quality and safety attributes are closely related and are generally discussed in the same publication. Extension publications for consumers are oriented to the production of not only nutritious, tasteful, and aesthetically appealing--but also safe foods.

B. USDA's Responsibility to Assure That the Federal Government "Speaks With One Voice" When Issuing Dietary Guidance

Promotion of the Guidelines. HNIS continues to offer free copies of "Nutrition and Your Health: Dietary Guidelines for Americans," second

edition, published by USDA and DHHS in 1985, through the Consumer Information Center (CIC). Over 750,000 copies were distributed in 1987. Also offered are camera-ready copies of the bulletins for reproduction by others. ES and HNIS are conducting a study of users and uses of the bulletin and concepts it presents. Also CIC is surveying people who request single and bulk copies of the bulletin to provide information about these audiences and their reactions to the bulletin.

Keeping Guidelines current. The formation of a new Federal Dietary Guidelines Advisory Committee is being planned by HNIS. The Committee will review recent scientific evidence on diet/health relationships and make recommendations to the Secretaries of USDA and DHHS for changes they deem appropriate to the second edition of the Dietary Guidelines. These recommendations will be used by the two Departments to prepare the third edition of the Guidelines to be issued in the early 1990's.

Supplemental information. Additional HNIS materials devoted to helping put the Guidelines into practice include a Home Economics Teachers' Guide that promotes the use of the Guidelines with junior and senior high school home economics students. Also, a second set of seven "minibulletins" on menu planning, food shopping, food preparation, eating out, bag lunches, quick meals, and snacks is undergoing formative evaluation.

Uniformity within USDA. The Dietary Guidance Working Group of the Subcommittee for Human Nutrition initiated in 1986 is now fully functional. Two new members have been appointed to the Group--a liaison from the DHHS and a representative from USDA's National Agricultural Library. This is in addition to representatives from the eight USDA agencies--AMS, ARS, ERS, ES, FNS, FSIS, HNIS, and OGPA. This group is responsible for reviewing all USDA publications and materials that contain dietary guidance information to help ensure that they accurately reflect USDA's food and nutrition policy (as presented in the Dietary Guidelines for Americans and the Secretary's Statement of USDA's Food and Nutrition Policy), are supported by research-based knowledge, are objective in presentation, and are supportive across agencies of USDA.

Uniformity among Departments. The Department continues to work with other agencies, especially the DHHS and the Department of Defense (DOD), in promoting uniformity of dietary guidance messages. For example, USDA is represented on a newly formed DHHS dietary guidance coordinating committee and on the Coordinating Committee for the National Cholesterol Education Program sponsored by the National Heart, Lung and Blood Institute. Also, several USDA nutritionists participated in DOD's national conference on diet and fitness.

Coordination with private sectors. USDA brought to the attention of the American Heart Association (AHA) the extreme dietary change required to bring average diets into conformity with the guidelines for healthy adults proposed by AHA in December 1986. Discussions with the American Dietetic Association have resulted in the extensive use of the Dietary Guidelines and Your Diet (minibulletins) and potential cooperation in the future on dietary guideline related issues. USDA has interpreted its research and dietary guidance

policies for numerous commodity and trade associations who strive to develop products that meet consumer demands which are increasingly related to nutritional health issues. The American Red Cross 12-hour nutrition course developed cooperatively with HNIS and ES, continues to be used in Red Cross Chapters nationwide to interpret the Dietary Guideline concepts in practical, interesting ways shown to be successful in improving knowledge and food selection behavior through extensive evaluation. A Nutrition Education Task Force, under the direction of FDA, composed of government and industry representatives continues to meet quarterly.

Coordination with State and local programs. Although some Federal projects and publications have consumers as their audiences, most nutrition education activities are originated in or relayed through State and local programs. The first educational objective of the Extension Service's new national initiative for improving of nutrition, diet, and health is that adults and youth become aware of the practices recommended in the Dietary Guidelines for Americans. Nutrition messages in materials prepared for use in local Food Stamp Program centers are based on the Dietary Guidelines. HNIS' Home Economics Teacher's Guide will help promote the Dietary Guidelines through the school system.

Extension Service Nutrition Education. Food, nutrition and health programs continue to be a major program emphasis within Cooperative Extension Service. Each year, approximately 10-12 million people participated in this educational program. Additional people were reached through mass media efforts. In addition, approximately one third of all 4-H members have food and nutrition projects. All 50 states and 5 territories support major programs in food, nutrition and health. In addition, every county home economics program includes a food, nutrition and health component.

People of all age groups and income levels participate in Extension food, nutrition and health programs. The Dietary Guidelines in conjunction with research based information serve as the bases for developing program content. Programs are designed to assist consumers in making sound decisions that can positively affect their quality of life. Major program emphases are nutrient needs throughout the life cycle, the relationship of diet and fitness to overall health and well-being, evaluation of nutrition information, management of food resources, and understanding the factors that affect food quality.

C. Improved Linkages Between Research and Information and Education Activities

Various USDA agencies conduct research in a broad range of food, nutrition, and health topics basic to the targeting and the establishment of the content of nutrition education projects and programs. Customary reporting of research results continued through professional journals, press releases, papers, and exhibits at meetings of professional societies and other groups. Stronger research/educational linkages are recognized as desirable and some mechanisms were established. Examples are as follows:

- The Interagency Committee on Human Nutrition Research (ICHNR) has agreed that the Human Nutrition Research Information Management System (HNRIMS) data base, with information on federally-funded current research in some 34 defined areas of human nutrition, and the Current Research Information

System (CRIS) with information on research from the Cooperative State Research Service should be combined and made available for public use through DIALOG. This makes available to educators and others research plans and results on a most timely basis. Agencies contributing to the HNRIMS are the Departments of Agriculture (USDA), Commerce (DOC), Defense (DOD), and Health and Human Services (DHHS), the Veterans' Administration (VA), the Agency for International Development (AID), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF).

- o Bibliographies of print and audiovisual resources for three user levels (consumer, educator, health professional) are now available on 27 food and nutrition topics through the National Agricultural Library's Food and Nutrition Information Center.

- o A Memorandum of Understanding between the Human Nutrition Information Service and the Extension Service clarifies the intention of the two agencies to coordinate their respective and complementary research and education programs as a means of achieving their common goal--to enable individuals to make informed decisions about food and diet as a means of improving their health and well-being.

  Improved coordination will enhance the integration of research-based nutrition messages into public education and facilitate feedback from the public on information needs that can be met through future research. A CES panel is being formed to advise HNIS/ES staff on research and information needs and to evaluate existing and future efforts.

- o A series of meetings of ES, FNS, and HNIS and the Department of Education staff have focused on research-based nutrition education messages and techniques for reaching low-income, low-literacy adults. The main objective of the group is to identify mechanisms and means for communicating concepts of the Dietary Guidelines for Americans to low-literacy adults.

- o HNIS interpreted its food consumption behavioral research in regional and national workshops for public health nutritionists and WIC program educators. Recent survey results on food and nutrient intakes and dietary practices are used to target populations in need of guidance and to identify dietary problems that need to be remedied.

- o The 1987 Journalists' Conferences, jointly sponsored by USDA and FDA, which interpreted research and regulations on food and nutrition for journalists were convened in Washington, DC; Chicago, IL; and Denver, CO.

D. Coordinated Delivery of Message

Numerous activities in 1987 have been coordinated among USDA agencies at the Federal level to ensure conformity of message and prudent use of resources.

- o The second set of Dietary Guidelines "minibulletins" are being developed by HNIS with assistance from ES and other USDA and DHHS nutritionists and will be "delivered" through ES and other public and private education programs.

- Extension agents are also helping to promote the HNIS-developed Home Economics Teachers Guide in their communities. The Guide suggests lesson plans and activities for use in interpreting the Dietary Guidelines and the first set of "minibulletins" for use by junior and senior high school home economics students.

- The Food and Nutrition Service (FNS) Make Your Food Dollars Count nutrition education initiative for the Food Stamp Program (FSP) has been in existence since 1983. The project was designed to provide nutrition information to low-income households, particularly food stamp households, to help them buy and prepare nutritious foods that are low in cost. The Cooperative Extension Service assisted with the coordination, provided leadership in teaching, and also assisted with recruiting community leaders to attend the workshops.

  In four years the project has grown from a series of workshops to a coordinated national multi-media nutrition education project. Seven regional workshops have been conducted for nutrition professionals and community leaders to share meal plans, food buying tips, and instructions on counseling low-income individuals. Each regional workshop has prompted additional State and local workshops. The Cooperative Extension Service assisted with the coordination, provided leadership in teaching and also assists with recruiting community leaders to attend the workshops.

  Also, FNS has developed a variety of print and audiovisual materials to teach shopping and nutrition tips to FSP participants. The materials include a series of pamphlets, two colorful posters, newspaper reproducibles of the pamphlets, a slide-tape show, a project guide, and brief messages on the outside back covers of the food stamp coupon booklets. The pamphlets focus on various topics, for example: how to buy, store and prepare fruits, vegetables and legumes, and how to use less sugar, fat and sodium in the diet. All materials developed thus far are designed to be easily read and understood by adults with limited formal education.

  Currently, FNS is working on an initiative to promote the Make Your Food Dollars Count materials and information via public service announcements.

- Through a reimbursable agreement with FNS, FNIC continues to lend materials and technical support to FNS-administered programs and personnel, particularly school food service managers, educators, day care providers, and WIC nutritionists among others. During FY 1987, this agreement also supported the extension of special outreach, lending and reference services to nutrition educators and others who work with the Food Distribution Program on Indian Reservations.

  PATHFINDERS continue to be revised and updated, and the following new titles have been completed:

  - Commonsense Nutrition
  - Osteoporosis
  - Salmonella and Poultry
  - Children's Literature on Food & Nutrition
  - Irradiated Fruits

The Center continues to distribute single copies of the USDA/DHHS Dietary Guidelines as well as USDA's Dietary Guideline Bulletins in response to requests for general information about nutrition from consumers and educators.

- o In a joint effort of the public and private sectors, FNIC collaborated with the Department of Health and Human Services and the March of Dimes Birth Defects Foundation to produce Nutrition & Adolescent Pregnancy: A Selected Annotated Bibliography. It is intended to serve as a source of technical assistance for nurses, nutritionists, physicians, educators, social workers, and other personnel concerned with improving the health of teenage mothers and their babies.

  FNIC database searches are sometimes published in the form of Quick Bibliographies, which are designed to serve as research aids for recent investigations on a particular topic. Recent titles include:

  - Diet, Race, and Ethnicity in the U.S.: Research and Reference Materials (1979-1986)
  - Iron and Human Nutrition: Research and Reference Materials (1982-1986)
  - Infant Nutrition: Research and Reference Materials (1984-1986)
  - Nutrition Education Materials: Preschool through Grade 6 (1979-1986)
  - Nutrition Education Materials: Grades 7-12 (1979-1986)

- o The Electronic Food and Nutrition Information Service, initiated in 1986 as part of USDA ONLINE on the Dialcom computer system, has also been added to the Department's EDI system. The EDI system is USDA's main information service for delivery of current information under a contract with Martin Marietta Data System. Inclusion on the EDI system increases the audience of the information through prime news users such as AgriData Resources, Inc., Agnet, Knight-Ridder Financial News, Pioneer Hi-Bred International, Inc. and other large multipliers of information.

- o Extension's Expanded Food and Nutrition Education Program (EFNEP). This program, which began in 1968, continues to be a very effective program for the target audience of low-income families with small children to acquire the knowledge, skills, attitudes, and changed behavior necessary to improve their diet utilizing their meager resources well. Through an innovative approaches program, ways have been found to be more cost effective in program delivery while maintaining effective education through the paraprofessional system of educators. The major audience for this program are the Food Stamp recipients. ES and FNS are working to improve coordination and delivery of services.

IV. FUNDING LEVELS (1983-1988)

The expenditures for human nutrition research and human nutrition education and information by the several agencies in USDA for fiscal years 1983 through 1986 are summarized in Table 2. The estimated expenditures for FY 1987 and the Congressional appropriation for FY 1988 are also included. The total amount of human nutrition research support has increased from $47.8 million in fiscal

Table 2

U.S. DEPARTMENT OF AGRICULTURE
HUMAN NUTRITION RESEARCH, EDUCATION AND INFORMATION
SUPPORT (FY 83-88)

HUMAN NUTRITION RESEARCH
($ in Millions)

	FY 1983 actual	FY 1984 actual	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 estimate
ARS	31.7	34.3	36.9	37.8	40.6	44.3
CSRS	7.8	7.7	7.3	7.4	7.5	7.7
HNIS	6.7	5.3	6.0	12.8	6.1	7.7
ERS	0.9	0.7	0.7	1.1	1.2	1.4
FNS	0.7	5.4	1.4	1.5	0.5	0.4
TOTAL	47.8	53.4	52.3	60.7	55.9	61.5

Human Nutrition Education and Information

ES	76.1	76.6	77.0	73.5	73.5	75.0
HNIS	1.0	0.7	0.7	1.2	0.7	0.9
FNS	42.0	50.5	55.0	57.6	60.4	61.0
FSIS	0.4	0.3	0.5	0.4	0.13	0.12
NAL	0.4	0.4	0.4	0.5	0.4	0.5
TOTAL	120.0	128.5	133.6	133.2	135.1	137.5

TOTAL RESEARCH, EDUCATION AND INFORMATION	167.8	181.9	185.9	193.9	191.0	199.0

Table 3

USDA NUTRITION RESEARCH PROGRAM SUPPORT (FY 83-88)
($ in Millions)

	FY 1983 actual	FY 1984 actual	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 estimate
1. Nutrient Requirements/ Health Maintenance						
CSRS	2.7	3.3	3.6	3.7	4.8	5.0
ARS	26.4	27.3	26.3	27.5	29.9	31.0
Total	29.1	30.6	29.9	31.2	34.7	36.0
2. Nutritional Status/ Food Intake						
CSRS	2.8	2.8	2.3	2.4	1.4	1.4
ARS	0.7	0.6	2.3	3.1	3.9	3.9
HNIS	3.5	2.6	3.2	9.9	3.2	4.8
Total	7.0	6.0	7.8	15.4	8.5	10.1
3. Use of Food/Food Choices						
CSRS	0.4	0.3	0.2	0.3	0.3	0.3
HNIS	1.7	1.1	1.1	1.1	1.1	1.1
ERS	.6	0.4	0.4	0.8	0.9	0.9
Total	2.7	1.8	1.7	2.2	2.3	2.3
4. Nutrient Composition/ Bioavailability						
CSRS	1.8	1.3	1.6	1.0	1.0	1.0
ARS	4.7	6.5	8.3	7.2	6.8	9.4
HNIS	1.5	1.6	1.7	1.8	1.8	1.8
Total	8.0	9.4	11.6	10.0	9.6	12.2
5. Nutritional Impacts of Programs						
CSRS	0.1	--	--	--	--	--
ERS	0.3	0.3	0.3	0.3	0.3	0.5
FNS	0.7	5.4	1.4	1.5	0.5	0.4
Total	1.1	5.7	1.7	1.8	0.8	0.9
TOTALS						
CSRS	7.8	7.7	7.3	7.4	7.5	7.7
ARS	31.7	34.3	36.9	37.8	40.6	44.3
HNIS	6.7	5.3	6.0	12.8	6.1	7.7
ERS	0.9	0.7	0.7	1.1	1.2	1.4
FNS	0.7	5.4	1.4	1.5	0.5	0.4
USDA Total Nutrition Research	47.8	53.4	52.3	60.7	55.9	61.5

Table 4

USDA FOOD AND NUTRITION EDUCATION AND INFORMATION SUPPORT (FY 83-88)
($ in Millions)

	FY 1983 actual	FY 1984 actual	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 estimate
Extension Service[1/]						
Extension (Formula est.)	15.8	16.2	16.7	15.9	15.9	16.4
Expanded Food and Nutrition Education Program (EFNEP)	60.4	60.4	60.3	57.6	57.6	58.6
Total	76.1	76.6	77.0	73.5	73.5	75.0
National Agricultural Library						
Food, Nutrition and Human Ecology Staff	0.4	0.4	0.4	0.5	0.4	0.5
Human Nutrition Information Service						
Nutrition Education Division	1.0	0.7	0.7	1.2	0.7	0.9
Food and Nutrition Service[1/]						
Nutrition Education & Training Program (NET)	5.0	5.0	5.0	5.0	5.0	1.0
Special Supplemental Food Program for Women, Infants and Children (WIC)[2/]	37.0	45.5	50.0	52.6	55.4	60.0
Total	42.0	50.5	55.0	57.6	60.4	61.0
Food Safety and Inspection Service						
Nutrition Labeling	0.08	0.1	0.1	0.1	0.1	0.1
Nutrition and Sodium Information	0.06	0.1	0.1	0.1	0.02	0.01
Sodium Monitoring Program	0.28	0.1	0.3	0.2	0.01	0.01
Total	0.42	0.3	0.5	0.4	0.13	0.12
USDA Total Nutrition Education and Information	120.0	128.5	133.6	133.2	135.1	137.5

1/ Most funds are distributed to and managed by State agencies.

2/ Estimate of State administrative funds allocated for nutrition education.

Table 5

AGRICULTURAL RESEARCH SERVICE
HUMAN NUTRITION RESEARCH SUPPORT (FY 1983-88)

Estimated Funds (In millions of dollars)

		FY 1983 actual	FY 1984 actual	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 estimate
BHNRC, Beltville, MD	Gross	7.92	7.97	8.00	7.91	8.34	8.42
	Net	6.98	6.98	7.30	7.02	7.41	7.35
GFHNRC, Grand Forks, ND	Gross	5.41	5.72	6.19	6.36	6.66	7.11
	Net	5.06	5.33	5.57	5.64	5.92	6.32
HNCA, Boston, MA	Gross	7.19	9.59	11.35	11.75	12.76	13.68
	Net	6.84	9.12	10.79	11.16	12.12	12.99
CNRC, Houston, TX	Gross	2.95	3.27	3.59	4.43	5.43	7.65
	Net	2.69	2.96	3.23	3.93	4.88	6.99
WHNRC, San Francisco, CA	Gross	3.48	3.81	3.79	3.66	4.23	4.49
	Net	3.05	3.33	3.42	3.25	3.76	3.95
TOTAL, HN Centers	Gross	26.95	30.36	32.93	34.12	37.43	41.35
	Net	24.61	27.70	30.31	31.01	34.09	37.59
Other ARS HN Research	Gross	3.93	3.97	3.88	3.65	3.18	3.01
	Net	3.25	3.27	3.49	3.24	2.86	2.65
TOTAL, Human Nutrition	Gross	30.88	34.33	36.81	37.76	40.61	44.36
	Net	27.86	30.97	33.80	34.24	36.95	40.25

Table 6

AGRICULTURAL RESEARCH SERVICE

OTHER ARS HUMAN NUTRITION RESEARCH SUPPORT (FY 83-88)*
(In thousands of dollars)

		FY 1983 actual	FY 1984 actual	FY 1985 actual	FY 1986 actual	FY 1987 actual	FY 1988 estimate
Beltsville, MD	Gross	187.0	187.0	--	--	--	128.7
	Net	155.0	155.0	--	--	--	111.8
Ithaca, NY	Gross	295.5	305.0	551.5	601.3	750.9	765.0
	Net	242.1	246.7	496.6	533.5	675.9	676.0
Wyndmoor, PA	Gross	573.7	580.2	700.5	667.1	303.1	--
	Net	468.6	471.2	630.6	591.8	272.9	--
Peoria, IL	Gross	1,178.5	1,184.4	1,023.8	985.5	982.4	1017.5
	Net	983.7	985.3	921.7	874.5	884.3	898.8
Albany, CA	Gross	1,400.4	1,412.2	1,007.9	959.2	712.7	653.8
	Net	1,157.1	1,161.3	907.5	851.0	641.5	576.3
Athens, GA	Gross	291.4	302.2	149.0	--	--	--
	Net	244.6	249.8	134.1	--	--	--
Hyattsville, MD	Gross	--	--	449.0	433.5	432.7	443.1
	Net	--	--	404.2	384.6	389.5	391.0
	Gross	3,926.5	3,971.0	3,881.7	3,646.6	3,181.8	3,008.1
	Net	3,251.1	3,269.3	3,494.7	3,235.6	2,864.1	2,653.9

* Excludes Human Nutrition Centers

year 1983 to $61.5 million in fiscal year 1988, an increase of 28.7 percent. During the same period, support for human nutrition education and information has increased from $120.0 to $137.5 million, an increase of 14.6 percent. The total support for human nutrition in the Congressional appropriation for FY 1988 is $199.0 million or 18.6 percent more than was expended in FY 1983.

Table 3 shows the amount of human nutrition research support within the Department for this period by subject area categories and agency. Half of the human nutrition research effort is focused on determining nutrient requirements/health maintenance at all stages of life. One-fourth of the effort relates to the development of methods for measurement of nutritional status and collection of food consumption information. Approximately 1/6 of the funds are used to measure the content and bioavailability of nutrients in foods. The funds shown in the table do not include funds provided by the States or other sources and used in conjunction with those funds provided by the Cooperative State Research Service (CSRS).

Table 4 presents a breakdown of human nutrition education and information expenditures and budgets by subject category for the fiscal years 1983 through 1988.

A summary of actual expenditures, estimated support and the Congressional appropriation is given in Table 5 for the five Human Nutrition Research Centers and other Laboratories or Centers of the Agricultural Research Service (ARS) for fiscal year 1983 through fiscal year 1988. The net figure refers to funds to the location, while the gross amount includes overhead costs.

The Center at Tufts University in Boston is operated by ARS as a government-owned, contract-operated (GOCO) facility. The Center at Baylor College of Medicine in Houston is operated by ARS through a cooperative agreement.

Human nutrition research support at ARS Regional Research Centers and other Laboratories is shown in Table 6. These studies help to assure that problems and opportunities in human nutrition are considered in research directly related to the quality of the food supply.

V. COORDINATION AND ADVISORY MECHANISMS

A. Coordination Within the Federal Sector

1. Interagency Committee on Human Nutrition Research

Nutrition research continued to be coordinated at the Federal level through the Interagency Committee on Human Nutrition Research (ICHNR) with participation by USDA, DOC, DOD, DHHS, AID, VA, NASA, and NSF. Regular meetings in 1987 cochaired by the Assistant Secretary for Science and Education (USDA) and the Assistant Secretary for Health (DHHS) fostered communication among research agencies and sponsored the following activities:

- The Third Conference for Federally Supported Human Nutrition Research Units and Centers. This conference, held February 24-25, 1987, addressed two topics of special interest to Federal nutrition researchers--Human Nutrition Requirements and Dietary Intake Methodologies. Twenty-one of the thirty-nine papers presented were given by USDA scientists. The meeting included researchers from Clinical Nutrition Research Units supported by NIH, several Veteran Administration laboratories, National Aeronautics and Space Agency, Department of Defense, Agency for International Development and the Food and Drug Administration. This Conference, held at 2-year intervals is considered to be a most valuable activity sponsored by the Interagency Committee on Human Nutrition Research, as a forum for information exchange and stimulus for research collaboration. A summary of the conference is being prepared for publication.

- Subcommittee on Technology, Nutrition, and Food Production. A standing committee, chaired by Orville Bentley, was formed to monitor the scientific, regulatory and marketing developments with implications for the food supply. Agencies represented include USDA, FDA, DOC, and AID.

- Subcommittee on Research and the RDA's. This task-oriented subcommittee has the responsibility for identifying scientific issues that are relevant for the setting of dietary allowances. Agencies represented include NIH, USDA/ARS, DOD and VA.

- Subcommittee on Nutrition Monitoring. This subcommittee was formed to provide interagency coordination for the NNMS with cochairs from the Offices of the Assistant Secretaries for Food and Consumer Services (USDA) and for Health (DHHS). Early tasks of the Subcommittee are to define terms and to list and prioritize research needs, especially in the area of nutrition monitoring methodologies.

2. USDA/DHHS Cooperation on Nutrition Monitoring

Other NNMS efforts have involved extensive coordination between USDA and DHHS.

- Joint Operational Plan for the National Nutrition Monitoring System

This plan was prepared under direction of the Assistant Secretaries for Health (DHHS) and for Food and Consumer Services (USDA) and sent to Congress in August 1987. The Operational Plan defines goals and plans for NNMS for the period of 1987-1996 and follows the period covered in the Joint Implementation Plan sent to Congress in 1981.

- Report to Congress from the National Nutrition Monitoring System

This report, to be submitted in 1989, has been initiated. The scientific basis for the report, for which the nature of the content was defined by a USDA/DHHS Steering Committee, will be prepared under contract by the Life Sciences Research Office of the Federation of American Societies of Experimental Biology.

- HNIS and NCHS Cooperation

The HNIS/USDA and the National Center for Health Statistics (NCHS), DHHS, are continuing their joint planning and collaboration in conducting the USDA Food Consumption Survey and the NCHS National Health and Nutrition Examination Survey, the core surveys of the National Nutrition Monitoring System. This collaboration as well as the joint publication of the Dietary Guidelines for Americans are coordinated by the Assistant Secretaries for Health in DHHS and for Food and Consumer Services in USDA.

3. Other Federal Sector Coordination

- The USDA/DHHS Nutrition Education Committee for Maternal and Child Nutrition Publications

The USDA/DHHS Nutrition Education Committee for Maternal and Child Nutrition Publications was established in November 1980 by the Assistant Secretary for Health, DHHS and the Assistant Secretary for Food and Consumer Services, USDA. The purpose of the Committee is to coordinate efforts on producing nutrition education materials related to pregnancy and infant care to be used by program staff serving mothers and children. There is a USDA and DHHS coordinator for this joint effort. A staff member of the Nutrition and Technical Services Division, Food and Nutrition Service, serves as the USDA coordinator. The Committee meets three times per year and submits an annual report of coordinated efforts and joint projects. The Committee has stimulated greater collaboration on projects and wider dissemination of information in the area of maternal and child nutrition.

- NAL and NLM Develop Coordinated Program

NAL and the National Library of Medicine (NLM) have reviewed their collection development policies in human nutrition and related subjects, and have issued a joint statement which summarizes their respective collection responsibilities. NAL, NLM, and the Library of Congress cooperate to ensure that significant literature in human nutrition is collected, retained, and preserved at the national level and to make this literature accessible to the wide variety of researchers and practitioners throughout the U.S.

FNIC has continued its coordination efforts by maintaining national networks for the dissemination of food and nutrition information. State school food service personnel, WIC nutrition educators, NET Program Coordinators, and school nurses currently participate in these networks.

- Development of Reports on Cholesterol and on Calcium for the Congress

During FY 1987, scientists in USDA and the National Institute of Diabetes and Digestive and Kidney Diseases and the National Heart, Lung, and Blood Institute completed the preparation, review, and submission of two reports to Congress in accordance with the Food Security Act of 1985, P.L. 99-198, Subtitle B, Section 1453. These were: "The Relationship Between Dietary Cholesterol and Blood Cholesterol and Human Health and Nutrition" and "Assessment of the Existing Scientific Literature and Research on Dietary Calcium and Its Importance in Human Health and Nutrition."

- o ARS Nutrient Composition Laboratory and HNIS Nutrient Data Research

There is very close interaction between the ARS Food Composition Laboratory and the HNIS Nutrient Data Research Branch in planning and conducting food composition studies and in compiling and documenting results. The ARS Human Nutrition Research Center at Beltsville, Maryland, and the National Heart, Lung and Blood Institute of NIH have a long history of collaboration in food composition research directed primarily toward developing accurate, precise methods for determination of lipids in foods, particularly fatty acids and cholesterol. The Nutrient Composition Laboratory also has conducted research supported by the National Cancer Institute to develop methods for measuring carotenoids in foods. In addition, the Lipid Nutrition, Nutrient Composition, and Vitamin and Mineral Nutrition Laboratories of the Center have collaborated with the National Cancer Institute in studies on dietary fat and steroid metabolism in relation to cancer risk in healthy adults. Collaborative studies also are underway with the National Bureau of Standards in the development of appropriate food/biological reference materials characterized for nutrient content.

B. Coordination Within USDA

- o Subcommittee for Human Nutrition

The Subcommittee for Human Nutrition of the Department's Research and Education Committee continued to serve as the focal point for coordination of human nutrition activities through regular monthly meetings of representatives from those agencies involved. In addition to assuring the exchange of current information between agencies and offices involved, the Subcommittee serves as the Department's mechanism for exploring and making recommendations on human nutrition related policy issues. The Subcommittee has developed a food and nutrition policy statement, a directory of USDA activities related to human nutrition, and a USDA Comprehensive Plan for a National Food and Nutrition Research and Education Program, a report sent to Congress in 1986. This report was prepared through the Subcommittee. The Subcommittee has established a Dietary Guidance Working Group to ensure that USDA informational materials conform to the Dietary Guidelines for Americans.

- o Dietary Guidance Working Group

The Dietary Guidance Working Group, formed under the Subcommittee for Human Nutrition in 1986, is now fully functional. It has reviewed numerous prospectuses and publication drafts presenting dietary guidance. The review process is thorough and timely. It has demonstrated the value of such a group for ensuring that guidance conforms to the Dietary Guidelines and is consistent and supportive across USDA agencies and the Federal government. The group has also served as a means of communication among nutrition education specialists in the USDA agencies that provide guidance to their respective clientele.

- o FNS and HNIS Cooperate on Standards

The FNS and HNIS cooperate in the development of certain food assistance program standards, such as the thrifty food plan for establishing benefits in the Food Stamp Program and meal patterns for measuring compliance in the

National School Lunch Program. HNIS-generated data bases on food composition and food consumption and prices are used in developing the standards.

o HNIS and ERS Cooperate on Food Supply Data

The ERS and HNIS cooperate in estimating and publishing information on trends in the nutrient content of U.S. food supplies.

o Commodity Programs Consider Dietary Guidelines

The Agricultural Marketing Service has engaged in major commodity initiatives with the Food and Nutrition Service and the Agricultural Stabilization and Conservation Service to be more responsive to the needs of participants in school feeding programs. The initiatives focus on kinds and forms of commodities purchased for distribution, and consideration is given to the USDA/DHHS Dietary Guidelines.

o USDA Agency Publications Used by Extension System

As one can see in Table 7, many of the nutrition and food safety publications produced in USDA by other agencies are being utilized and distributed by the Extension System. In many cases we only have a count of the initial distribution or of a cost-share order. In most cases the information in these publications is modified or rearranged at the state or local level and then printed or copied locally for their specific needs. This kind of multiplying effect is quite extensive and becomes a very significant factor in the utilization of other agency's publications by the Extension system. Unfortunately, we have no way of gathering those statistics.

o Memorandum of Understanding (MOU) Between Extension Service and Human Nutrition Information Service

A MOU between ES and HNIS was prepared to clarify the intentions of the two agencies to work together in achieving their common goals in nutrition education. A panel of Cooperative Extension Service nutrition educators in the States is being formed to advise HNIS/ES staff concerning future nutrition education information needs.

C. Coordination With the Private Sector

o The National Healthy Mothers, Healthy Babies Coalition

In 1981 the National Healthy Mothers, Healthy Babies Coalition was formed to support the cause of healthier mothers and infants. Today, the Coalition consists of 85 national voluntary, professional and governmental organizations committed to improving maternal and infant health through public education. As a member of the Coalition, Food and Nutrition Service staff actively participate on the Steering Committee, Subcommittee on Breastfeeding Promotion, Adolescent Pregnancy Subcommittee, Substance Use Subcommittee, and the Low-Income Women Subcommittee.

The Coalition provides a mechanism for individuals and organizations to share ideas for improving maternal and infant health. The Coalition avoids advocating any particular position or issue, thus offering a neutral meeting

Table 7

USDA Agency Publications Used by Extension System
(1985-present)

Agency/Publication	Number Distributed*
Food Safety and Inspection Service (FSIS)	
Safe Food Book	97,212
Safe Food to Go	39,315
Talking About Turkey	79,265
Food News for Consumers (quarterly)	710/qtr**
Meat and Poultry Labels--Wrap it Up	5,000 (initial mailing)
Human Nutrition Information Service (HNIS)	
Dietary Guidelines and Your Health	5,000 distributed with 63,000 cost-shared
Dietary Guidelines	5,000 distributed with 465,000 cost-shared and camera-ready copy distributed for reproduction
Dietary Guidelines (Spanish)	5,000 plus
Nutritive Value of Foods	5,000 distributed with 52,000 cost-shared
Composition of Foods (Updates)	225
Nationwide Food and Consumption Survey-Continuing Survey of Food Intakes by Individuals-CSFII	125
Economic Research Service (ERS)	
National Food Review (quarterly)	2,400 + cost-shared/qtr.
Agricultural Outlook Speeches	distribution varies, but at least to all state leaders
Agriculture Chart Book	5,000
Food Costs from Farm to Retail	5,000
Food Marketing Review (annual)	250
Food Security Act of 1985	1,000
U.S. Demand for Food, Households	140
Agricultural Research Service (ARS)	
Family Economics Review (quarterly)	2,000/issue
Nutrition Research Brief (monthly)	200 +
Food and Nutrition Service (FNS)	
Making Your Food Dollars Count (flyer)	300,000 (distributed
Making Your Food Dollars Count (booklet)	500,000 through the
Thrifty Meals for Two	500 EFNEP program)

**Some Extension staff subscribe directly with FSIS for this publication. Total number used by Extension staff is actually higher.

*Number distributed through Extension only. Actual distribution number to Extension staff may be higher.

ground for organizations with divergent opinions on some maternal and infant health issues. FNS involvement in coalition activities has benefited FNS' WIC and Commodity Supplemental Feeding programs by facilitating interaction with health care providers at the national and state levels who in turn have assisted in identifying and referring high-risk participants to FNS programs.

o Workshop on Industry Research Needs

A workshop was held at the Beltsville Human Nutrition Research Center in June to exchange information with industry on lipid research findings and to identify those research questions related to dietary fat and of importance to industry. Participants included representatives of the soybean, cottonseed, red meat, poultry, dairy and processed food industries. It was agreed that more information was needed about the ideal makeup of fatty acids in the total diet in order for each commodity group to better know how to modify their products to improve the quality of the food supply even at lower levels of fat intake.

o Marketing Promotion Expanded

Industry financed research and promotion programs for beef, pork, and honey were initiated in October and November 1986, and in February 1987, respectively. These programs, along with those for potatoes, eggs, and dairy, are authorized by Federal statute and fall under AMS' oversight responsibility.

o National Dairy Promotion and Research Board and an Extension Advisory Group

The National Dairy Promotion and Research Board and an Extension advisory group assisted with the development of a package of educational materials entitled "Calcium for the Prime of Life," for Extension use. Release of the videotape and supporting materials is scheduled for early 1988. This project illustrates the growing recognition of nutrition education as an integral part of making American agriculture profitable and productive, and it indicates that industry recognizes the wealth of expertise within the Extension system.

o Human Nutrition Information Coordinating Team

The Human Nutrition Information Coordinating Team has been investigating various methods and opportunities for cooperative programs in publishing and developing nutrition information materials with the private sector or other governmental groups. Currently, the Team is working with the Consumer Information Center (CIC) in developing ideas for multiagency coordinated information materials that could be presented by the CIC to private sector and other governmental agencies for possible cooperative publishing. Also, at the Team's suggestion, a program on cooperative publishing was presented at a regular meeting of the USDA Public Affairs Council (PAC). The PAC consists of USDA agency directors of information, their deputies, and other staff members responsible for disseminating public information.

o Wellness in the Worksite

In 1982, the U.S. spent more than $320 billion for health care. This is more than 10 percent of our gross national product. Each year, 500 million workdays are lost due to illness or disability--26 million due to heart

disease and hypertension; 93 million due to lower back problems. Employer health care costs are rising at the rate of 25 to 100 percent a year--an estimated 25 percent of total payroll for health care. USDA Food and Fitness program joined forces with the nation's life and health insurance industry in developing a manual which promotes worksite wellness. The purpose of the manual is to assist employers in developing and implementing worksite wellness programs for employees at all levels. Suggestions and resources are given for program implementation so that employees can control the major risk factors such as smoking, high blood pressure, blood cholesterol levels, and diabetes. Other factors that employees can control are obesity, lack of exercise, and stress. Copies were made available to all county Extension offices to promote its use in their local areas. USDA has received over 2,000 requests for the manual as a result of a press release that has been picked up by all the major U.S. newspapers. All USDA agencies have received copies of the manual and FmHA has used the manual in all their State and county offices for their employees wellness program.

D. Advisory Groups

1. Human Nutrition Board of Scientific Counselors (HNBSC)

The HNBSC has developed several recommendations for the Secretary regarding the Department's nutrition education efforts. These are:

- The nutrition education programs of the Department should provide consistent, accurate, clear, concise, and useful information to help consumers make informed food choices. This information will also assist the food industry.

- The U.S. Dietary Guidelines should be used as the basis for developing all nutrition education programs conducted by the Department. The Department should, whenever necessary, target this information to selected groups. Coordination and communication with the Human Nutrition Information Service and Extension nutrition specialists should be improved.

- The educational materials developed by the Human Nutrition Information Service should meet the needs of the Extension Service. The organizational structure makes this difficult, but the Committee believes such coordinated effort is absolutely essential.

- Nutrition education specialists in Extension should be integrated as faculty members in academic departments at land grant institutions. This will facilitate the dissemination of information and enhance specialists' expertise.

- The Department should increase nutrition expertise at the Federal level to provide appropriate leadership for fostering and enhancing federal coordination with state and county programs.

- Centers of Excellence in Extension nutrition should be implemented within institutions that have strong nutrition programs. These centers should also provide opportunities for fellowships in nutrition education. The Task Group recognizes that implementation of these recommendations may require retention of more funds at the Federal level.

In addition, the HNBSC expressed their concurrence with all of the recommendations contained in the report "Food and Nutrition: The Link Between Health and Agriculture--Directions for the Cooperative Extension Program, Cornell University, 1987, Ithaca, New York."

2. FNS' Advisory Councils

FNS' two advisory councils, the National Advisory Council on Child Nutrition (NACOCN) and the National Advisory Council on Maternal, Infant and Fetal Nutrition (NACMIFN), meet biennially to determine how program administration and operations can be improved. Descriptions of the councils and their activities were included in the first USDA Human Nutrition Research Report to Congress.

3. Extension Service's Expert Advisory Panel

The Expert Advisory Panel convened by the Extension Service to explore the opportunities in food and nutrition education and to make recommendations for future directions in extension education completed its task. Their report suggests several new initiatives, including (1) designate Centers of Excellence, (2) increase visable research linkages, (3) initiate issue-oriented exchanges, (4) expand and revitalize the nutrition education network and (5) strengthen USDA's nutrition education efforts.

The Cooperative Extension system intends to redefine and refocus its food and nutrition efforts. It reaches into every state and 3,150 counties in the United States. The nation's rapidly changing demographic picture presents a major challenge to nutrition educators and to the food system. Today the scientific community recognizes that health can be affected by dietary components that are not necessarily essential nutrients. The Panel's report is entitled "Food and Nutrition. The Link Between Health and Agriculture. Directions for the Cooperative Extension System" and was produced cooperatively by the Extension Committee on Organization and Policy, Extension Service, USDA and Cornell Cooperative Extension.

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